CHAPTER 1
PURPOSE AND NEED

CHAPTER 1

PURPOSE AND NEED

The Elko Field Office of the U.S.D.I. Bureau of Land Management (BLM) received an amendment to the Plan of Operations from Newmont Mining Corporation (Newmont) in March 1997 proposing activities that would support continued operation and expansion of existing open-pit gold mining and ore-processing facilities at its South Operations Area Project. This amendment is known as the South Operations Area Project Amendment (SOAPA). The project is located on public and private lands approximately six miles northwest of the town of Carlin in both Eureka and Elko counties, Nevada (**Figure 1-1**). Since certain proposed facilities in the SOAPA are located on public land administered by BLM, review and approval of Newmont's amended Plan of Operations are required by BLM pursuant to 43 Code of Federal Regulations (CFR) 3809 (Surface Management Regulations). Due to the potential for the proposed project to result in significant environmental impacts, BLM determined that an environmental impact statement (EIS) would be necessary, as required by the National Environmental Policy Act of 1969 (NEPA).

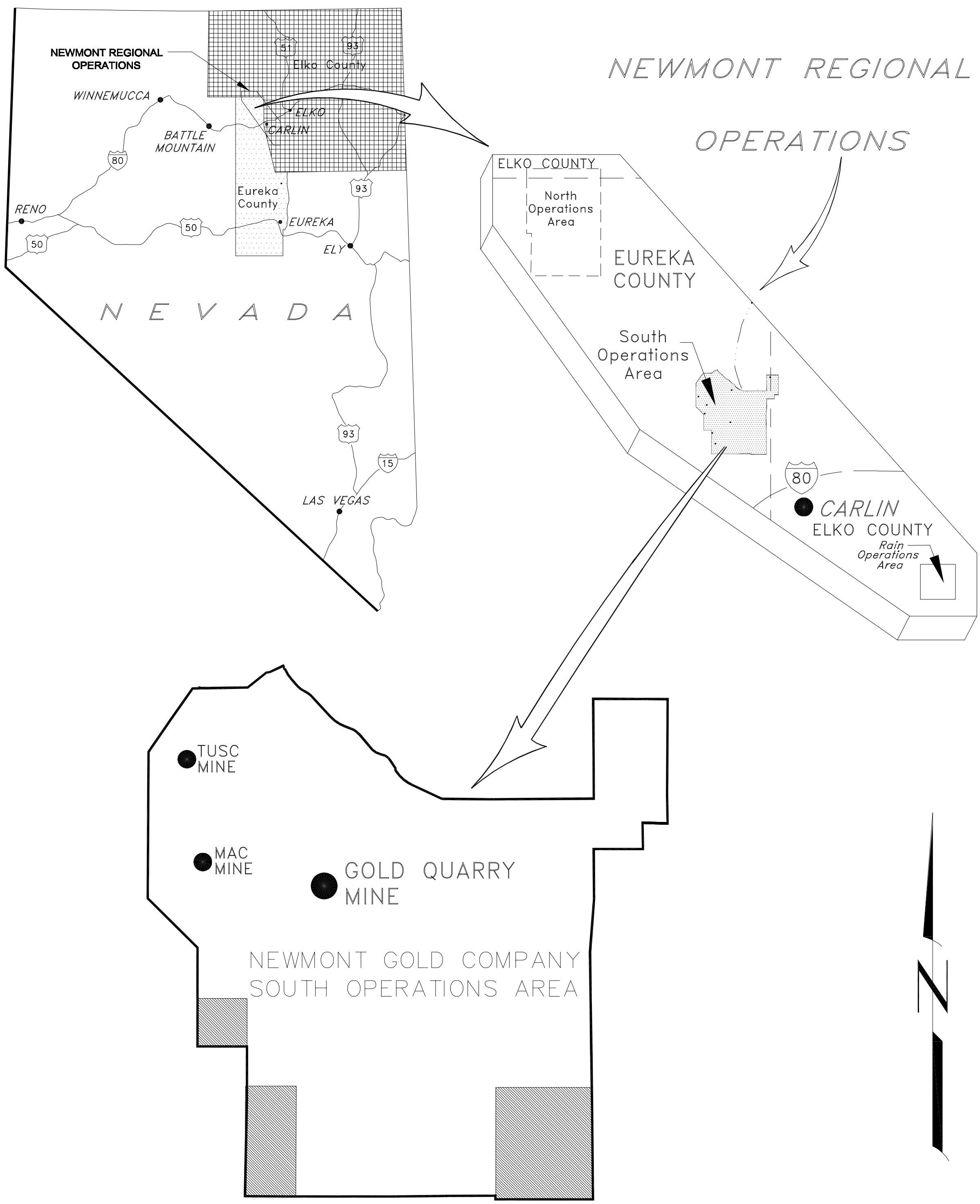
The BLM is serving as lead agency in preparing this EIS for the proposed continued operation and expansion of Newmont's existing gold mining operation. The U.S. Fish and Wildlife Service, Nevada Division of Wildlife, Elko County, and Eureka County are cooperating agencies in the preparation of this EIS. This document follows regulations promulgated by the Council on Environmental Quality for implementing the procedural provisions of NEPA (40 CFR 1500-1508) and BLM's NEPA Handbook (H-1790-1).

In 1993, the BLM prepared an EIS and issued a Record of Decision approving expanded mining operations in Newmont's South Operations Area Project. In many cases, this EIS will refer the reader to the original South Operations Area Project EIS (BLM, 1993) rather than repeat information that has not changed substantially over the past six years.

This EIS describes the components of, reasonable alternatives to, and environmental consequences of continued operation and expansion of mining and processing facilities in the South Operations Area. Chapter 1 describes Purpose and Need, the role of BLM, and summarizes public participation in the EIS process. Chapter 2 provides a complete description of the existing operations and Proposed Action, and alternatives to the Proposed Action. Chapter 3 describes the existing environment in the SOAPA area. Direct, indirect, and cumulative impacts associated with the Proposed Action and alternatives, and possible mitigation measures to reduce or minimize impacts, are described in Chapters 4 and 5. Consultation and coordination with federal, state, and local agencies and a list of preparers is included in Chapter 6. Chapter 7 contains a list of references cited in developing the EIS, glossary, and a list of abbreviations.

PURPOSE AND NEED

Newmont's purpose in proposing the continued operation and expansion of its existing open-pit mining and ore-processing operations at the South Operations Area is to



LEGEND

Plan of Operations Amendment Area

SOURCE: NEWMONT 1997b.

SOUTH OPERATIONS AREA PROJECT AMENDMENT	
FIGURE 1-1 GENERAL LOCATION	
MINE AREA: SOUTH AREA	
DATE: 6/5/00	ACAD FILE: Fig1-1.DWG
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to use its existing work force, mining and milling equipment, and ore-processing facilities to produce gold from the Gold Quarry Mine, which would be expanded laterally and at depth. Gold is an established commodity with international markets. Uses include investments, standard for monetary systems, jewelry, electronics and other industrial applications. The need for the project is to recover as much of the mineral deposit as is technically and economically possible, consistent with applicable federal, state, and local environmental, permitting, and operational requirements to meet this demand.

AUTHORIZING ACTIONS

A proposed mining Plan of Operations submitted to the BLM may be approved only after an environmental analysis is completed as required by NEPA. BLM decision options include approving Newmont's SOAPA as submitted, approving alternatives to the amendment to mitigate environmental impacts, or approving the SOAPA with stipulations to prevent unnecessary or undue degradation of environmental resources.

A substantial portion of Newmont's proposed new facilities would be located in whole or in part on unpatented mining claims administered by BLM. Such operations must comply with BLM regulations for mining on public lands (43 CFR 3809, Surface Management Regulations), the Mining and Mineral Policy Act of 1970, and the Federal Land Policy Management Act of 1976. These regulations recognize the statutory right of mining claim holders to develop federal mineral resources under the Mining Law of 1872. These statutes, however, in combination with other BLM regulations also require the BLM to analyze proposed mining operations to ensure that: (1) adequate provisions are included to prevent undue or unnecessary degradation of public lands, (2) measures are included to provide for reasonable reclamation of disturbed areas, and (3) proposed operations will comply with other applicable federal, state, and local laws and regulations.

In addition to BLM, other federal, state, and local agencies have jurisdiction over certain aspects of the Proposed Action. **Table 1-1** provides a comprehensive listing of the agencies and identifies their respective permit/authorizing responsibilities.

Eureka County adopted their Land Use Plan in 1998. The Land Use Plan establishes county policy regarding federal decisions which may affect local land use and community stability.

RELATIONSHIP TO BLM AND NON-BLM POLICIES, PLANS, AND PROGRAMS

The amendment to the Plan of Operations has been reviewed for compliance with BLM policies, plans, and programs. The proposal is in conformance with the Minerals Management Prescription in the Elko Resource Management Plan, approved in March 1987.

This document uses “tiering” extensively to direct the reader to previously-published documents and analyses. This is done in accordance with NEPA regulations at 40 CFR 1502.20 and 1508.28. Tiering allows the EIS to summarize issues discussed in previous documents, incorporate those analyses by reference, and allows the lead agency to concentrate on the issues specific to the subsequent action. The subsequent document must state where the earlier documents are available. Tiering is appropriate when the sequence of analyses proceeds from an EIS to

TABLE 1-1
REGULATORY RESPONSIBILITIES

Authorizing Action	Regulatory Agency
Plan of Operations and Amendments*	BLM
National Environmental Policy Act	BLM
National Historic Preservation Act	BLM and Nevada **State** Historic Preservation **Office**
Native American Graves Protection and Repatriation Act	BLM
American Indian Religious Freedom Act	BLM
Clean Water Act (Section 404)*	U.S. Army Corps of Engineers
Microwave Radio Station License	Federal Communications Commission
Radio Station License	Federal Communications Commission
High Explosive License/Permit	Bureau of Alcohol, Tobacco, and Firearms
Industrial Artificial Pond Permit*	Nevada Division of Wildlife
Water Appropriation Permit	Nevada Division of Water Resources
National Pollutant Discharge Elimination System Permit	Nevada Division of Environmental Protection, **Bureau of Water Pollution Control**
Air Quality Operating Permit	Nevada Division of Environmental Protection, Bureau of Air Quality
Water Pollution Control Permit*	Nevada Division of Environmental Protection, Bureau of Mining Regulation and Reclamation
Mine Reclamation Permit*	Nevada Division of Environmental Protection, Bureau of Mining Regulation and Reclamation
Solid Waste Disposal Permit	Nevada Division of Environmental Protection, Bureau of Waste Management
Potable Water	Nevada Division of Health, Department of Human Resources
Tailing Impoundment - Construction Permit	Nevada State Engineer’s Office - Dam Safety
Sewer System Approval	Nevada Division of Health; Nevada Division of Environmental Protection, Bureau of Waste Management
Radioactive Materials License (Laboratory)	Nevada Division of Health
Safety Plan	Mine Safety and Health Administration
Endangered Species Act	U.S. Fish and Wildlife Service
Compliance with Land Use Plans	Eureka County

* Permit/Approval would be modified in response to the SOAPA.

a subsequent statement or analysis at a later stage. This is the case with SOAPA. The original EIS was prepared in 1993 and many of the resource analyses in that document still apply. Tiering in such cases is appropriate when it helps the BLM focus on the issues that are crucial for present management decisions and to exclude from consideration issues already decided or not crucial for present management decisions.

ISSUES

To allow an early and open process for determining the scope of significant issues related to the Proposed Action (40 CFR 1510.7), a public scoping period was provided by BLM. A Notice of Intent to prepare the EIS was published in the Federal Register on June 19, 1997. Publication of this notice in the Federal Register initiated a 30-day public scoping period for the Proposed Action that provided for acceptance of written comments through July 18, 1997. Details of scoping are presented in Chapter 6.

Public comments concerning the scope of the EIS are grouped according to general subject area and summarized in **Table 1-2**. This table also provides references to the sections of this EIS which respond to each issue raised in the comments.

TABLE 1-2 (continued)
ISSUES AND CONCERNS IDENTIFIED IN SCOPING

Issue	EIS Document Section(s)
Mine Dewatering	
Disruption of surface water and groundwater hydrology and impacts on water quality.	Chapter 3 - Water Resources Section Chapter 4 - Water Resources Section
Potential impacts of the cone of depression created by dewatering on fish and wildlife dependent on aquatic and riparian habitats.	Chapter 4 - Wetlands - Direct and Indirect Impacts Section Chapter 4 - Aquatic Habitat and Fisheries - Direct and Indirect Impacts Section
Potential effects of reduced flows in upper Maggie Creek on possible reintroduction of Lahontan cutthroat trout.	Chapter 4 - Threatened, Endangered, Candidate, and Sensitive Species - Direct and Indirect Impacts Section
Potential for the cone of depression from dewatering to impact the Carlin water supply.	Chapter 4 - Water Resources - Direct and Indirect Impacts Section
Mine Water Disposal	
Potential impacts of water discharge on channel stability of Maggie Creek and the Humboldt River.	Chapter 4 - Water Resources - Direct and Indirect Impacts Section
Potential impacts of changes in water quality and quantity on fish, wildlife, and stockwater.	Chapter 4 - Aquatic Habitat and Fisheries - Direct and Indirect Impacts Section Chapter 4 - Terrestrial Wildlife - Direct and Indirect Impacts Section Chapter 4 - Livestock Grazing - Direct and Indirect Impacts Section
Potential for increased flows in the Humboldt River to affect water rights or use by irrigators.	Chapter 4 - Water Resources Section
Potential for removal of groundwater from the basin to conflict with water rights and water management policy.	Chapter 3 - Water Resources Section Chapter 4 - Water Resources Section
Wildlife, Fisheries, and Aquatic Communities	
Potential impacts on avian breeding, nesting, cover, foraging habitat, and migration.	Chapter 4 - Wetlands - Direct and Indirect Impacts Section Chapter 4 - Terrestrial Wildlife - Direct and Indirect Impacts Section Chapter 4 - Threatened, Endangered, Candidate, and Sensitive Species - Direct and Indirect Impacts Section
Potential impacts on species of concern.	Chapter 4 - Threatened, Endangered, Candidate, and Sensitive Species - Direct and Indirect Impacts Section
Visual Quality	
Potential impacts to visual quality to viewers east of the project site.	Chapter 4 - Visual Resources Section
Land Use	
Restoration of pre-mining land uses following mining.	Chapter 2 - Reclamation Section
Potential impacts from new right-of-way extensions.	Chapter 4 - Land Use Section

TABLE 1-2 (continued)
ISSUES AND CONCERNS IDENTIFIED IN SCOPING

Issue	EIS Document Section(s)
Alternatives	
Partial or complete backfill of pits.	Chapter 2 - Alternatives Section
Cumulative Effects	
Potential cumulative impacts of dewatering activities of mines along the Carlin Trend.	Chapter 5 - Cumulative Effects - Water Resources; Riparian Areas and Wetlands Section
Potential cumulative impacts of past and anticipated mine expansions within the BLM Elko Area and Humboldt National Forest.	Chapter 5 - Cumulative Effects Section
Mitigation	
Measures to avoid, reduce, or compensate for direct and indirect habitat losses and other potential impacts on fish and wildlife.	Chapter 4 - Aquatic Habitat and Fisheries - Potential Mitigation and Monitoring Measures Section Chapter 4 - Terrestrial Wildlife - Potential Mitigation and Monitoring Measures Section
Monitoring	
Monitoring potential indirect impacts on the Humboldt River and tributaries.	Chapter 3 - Water Resources Section Chapter 4 - Water Resources - Potential Mitigation and Monitoring Measures Section Chapter 5 - Cumulative Effects Section
Reclamation	
Description in reclamation plan of final water quality in water-filled pit.	Chapter 2 - Proposed Action - Reclamation Section Chapter 4 - Water Resources - Direct and Indirect Impacts Section

CHAPTER 2
PROPOSED ACTION, INCLUDING ALTERNATIVES

CHAPTER 2

PROPOSED ACTION, INCLUDING ALTERNATIVES

This chapter provides a description of Newmont's existing operations in the South Operations Area, Newmont's Proposed Action to continue and expand operations in the South Operations Area, and reasonable alternatives to the Proposed Action. Alternatives considered are based on issues identified by the BLM and public comments received during the public scoping process and are intended to reduce or minimize potential impacts associated with the Proposed Action.

Newmont currently mines and processes gold bearing ore along a 38-mile segment of the Carlin Trend in northeastern Nevada. The proposed South Operations Area Project Amendment would allow the continued operation and deepening of the Gold Quarry pit and expansions to existing waste rock and leach facilities. The impacts have been assessed for the existing South Operations Area Project through year 2001, including the disturbance of 2,047 acres of public land and 5,913 acres of private land (BLM, 1993). The SOAPA would amend the existing Plan of Operations, N16-81-009P, continuing operations until the year 2011 and involving additional disturbance of 839 acres of public land and 553 acres of private land, and extend dewatering.

Development of the proposed facilities would occur on a combination of public and private lands. The majority of mining and ore processing facilities in the South Operations Area are located on private lands which Newmont owns or controls. The public lands are managed by the Elko Field Office of the BLM. In accordance with NEPA, the BLM has reviewed the SOAPA and determined that since the proposed project could potentially result in significant environmental impacts, an EIS would be necessary. Preparation of this document follows Council on Environmental Quality regulations under NEPA (Title 40 Code of Federal Regulations [CFR] Parts 1500-1508), BLM regulations at 43 CFR 3809, and the BLM NEPA Handbook (H-1790-1) pertaining to mineral operations conducted on public lands under the Mining Law of 1872, 30 USC 22 *et seq*.

Detailed discussions of the following topics are presented in Chapter 2:

- Newmont's existing operations in the South Operations Area.

- Newmont's Proposed amendment for the South Operations Area Project.

- Alternatives to the Proposed Action including the No Action Alternative and alternatives considered but dismissed from detailed analysis.

Activities in the South Operations Area have been expanded periodically since production began in 1985. In 1990, Newmont filed an amended Plan of Operations (N16-81-009P) with the BLM to secure authorization for construction of various mining and processing facilities, including: a combined waste rock and tailing storage facility, access roads, slurry and reclaim water pipelines, power distribution systems, underdrainage reclaim ponds, downstream cutoff trenches, monitoring wells, and topsoil stockpile areas. In May 1991, BLM approved the amended

Plan of Operations at the South Operations Area through December 30, 1994 (EA-NV-010-91-055).

In February 1992, Newmont filed an amended Plan of Operations with the BLM to expand the South Operations Area to include two satellite ore bodies, the Mac and Tusc deposits. Also proposed was a haul road from Newmont's North Operations Area to the South Operations Area. Other facilities proposed included waste rock disposal areas, heap leach pads, expansion of the existing tailing storage facilities, a mine dewatering system, and a water treatment and discharge system, refractory ore stockpiles, a sanitary landfill, exploration drilling, expansion of the Gold Quarry pit, construction of a roaster, and construction of bioleach facilities. The project required mine dewatering because of the expansion of the Gold Quarry pit both laterally and deeper. New facilities also included the construction of a roaster to treat refractory ore. The proposed amendment was evaluated with an EIS. In response to the EIS, Newmont prepared a Mitigation Plan to eliminate or reduce the potential impacts identified. The proposed amendment with mitigating measures was approved November 18, 1993 (BLM, 1993).

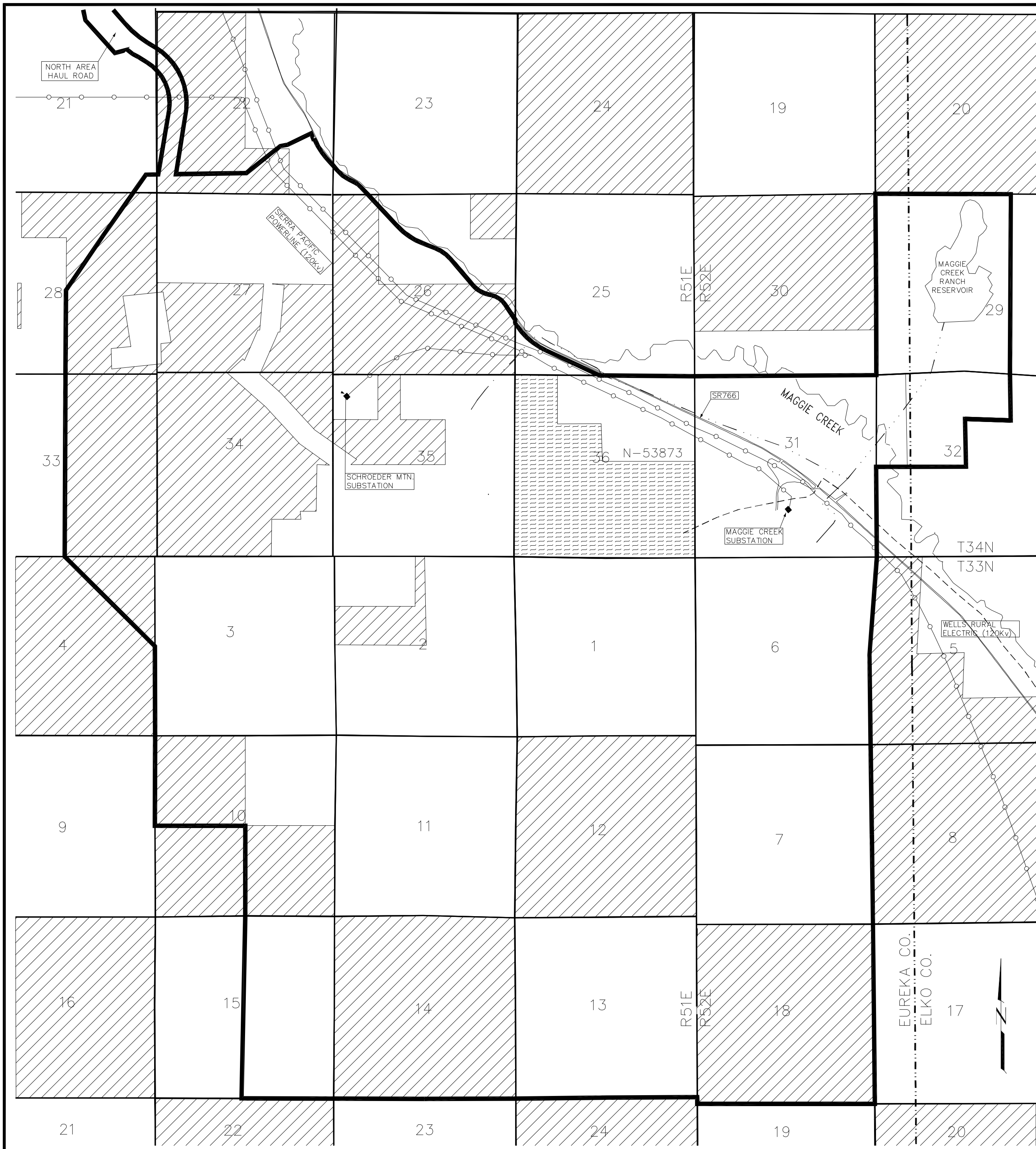
EXISTING OPERATIONS

This section describes Newmont's existing mining and processing operations in the South Operations Area. Location and land ownership, mining activities, processing facilities, water supply/mine pit dewatering, ancillary facilities/infrastructure, and current resource protection and monitoring activities relating to Newmont's existing operations are described below.

Location and Land Ownership

The South Operations Area is located at the eastern edge of the Tuscarora Mountains in the Maggie Creek Basin northwest of Carlin, Nevada. The facilities are located on 5,913 acres of private land and 2,047 acres of public (BLM) land in Township 33 North, Range 51 East; Township 33 North, Range 52 East; Township 34 North, Range 51 East; and Township 34 North, Range 52 East. **Figure 2-1** depicts surface ownership of lands and utilities, and **Table 2-1** shows the acreage of public and private lands disturbed under current authorization for each facility in the South Operations Area.

The existing facilities in the South Operations Area were designed, built, and are operated in compliance with the Nevada Administrative Code, Regulation Governing Design, Construction, Operation and Closure of Mining Operations (NAC 445A.350-445A.447), and other applicable state and federal regulations. Mining development in the South Operations Area has been ongoing since the Maggie Creek deposit was discovered in 1978. Development and construction of the Gold Quarry Mine and related support facilities were initiated in 1981. Mill 2 and the James Creek tailing facility processed the first ore from the Gold Quarry Mine in 1985. The Gold Quarry Leach Pad became operational in 1986. The second mill, Mill 5, was completed and commissioned in 1988. The South Area Leach Property and Non-Property leach facilities were constructed during 1988 and 1989. Beginning in 1993, Mill 2 was modified to process high grade refractory ore and was re-designated Mill 6. The Mill 5/6 tailing facility began receiving mill tailing in 1990.



LEGEND

PUBLIC SURFACE LANDS
PRIVATE SURFACE LANDS
FEDERAL OIL AND GAS LEASE
PLAN OF OPERATIONS BOUNDARY
SECTION LINE
POWERLINE
WATERLINE
GAS PIPELINE

0 1/4 1/2 3/4 1
Scale in Miles

SOURCE: NEWMONT 1997b.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 2-1
SURFACE OWNERSHIP AND UTILITIES

MINE AREA: SOUTH AREA	
DATE: 8/10/00	ACAD FILE: Fig2-1.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

TABLE 2-1
EXISTING AND APPROVED SURFACE DISTURBANCE

Facility	Disturbance Acreage		
	Public	Private	Total
Gold Quarry Mine	239	622	861
Tusc Mine	93	22	115
Mac Mine	43	0	43
Haulage Roads	141	328	469
Dewatering Facilities	8	385	393
Waste Rock Disposal Facilities			
Gold Quarry North Dump	0	407	407
Gold Quarry South Dump	118	510	628
Maggie Creek Dump	0	153	153
James Creek Dump	0	13	13
Tusc West Dump	154	20	174
Tusc North Dump	11	110	121
Mac Dump	105	0	105
Processing Facilities	0	244	244
Ore Stockpile Areas	5	290	295
Leaching Facilities			
Gold Quarry Leach Pad	0	185	185
Property Leach Pad	0	294	294
Property Leach Pad 2	--	--	--
Non-Property Leach Pad	0	397	397
Refractory Leach Pad	243	103	346
Tailing Facilities			
James Creek tailing facility	7	430	437
Mill 5/6 tailing facility	436	337	773
Diversion Channels	113	39	152
Topsoil Stockpiles	29	88	117
Ancillary Facilities	114	833	947
Geologic Evaluations	188	103	291
Total Disturbance Acreage	2,047	5,913	7,960

Newmont has built a low grade refractory ore demonstration leach facility, located on the Gold Quarry Leach Pad, to test and refine the refractory leaching process. Newmont has started construction of the foundation for the full-scale Refractory Leach Facility which is based on information gained from the demonstration facility.

The existing permitted disturbance area includes the Gold Quarry, Mac, and Tusc open pit mines, haul roads and access roads, water treatment and disposal facilities, waste rock disposal areas, the James Creek and Mill 5/6 tailing facilities, mill facilities, leach facilities, and shop and office complexes.

The South Operations Area's existing and approved facilities are shown on **Figure 2-2**. The existing facilities are described in detail in the Draft EIS for Newmont's South Operations Area Project (BLM, 1993). Many of the facilities, particularly ancillary facilities, have been modified or relocated over time. The BLM has reviewed all modifications on public lands and they were not considered significant, as defined inNEPA.

South Operations Area Open Pit Mines

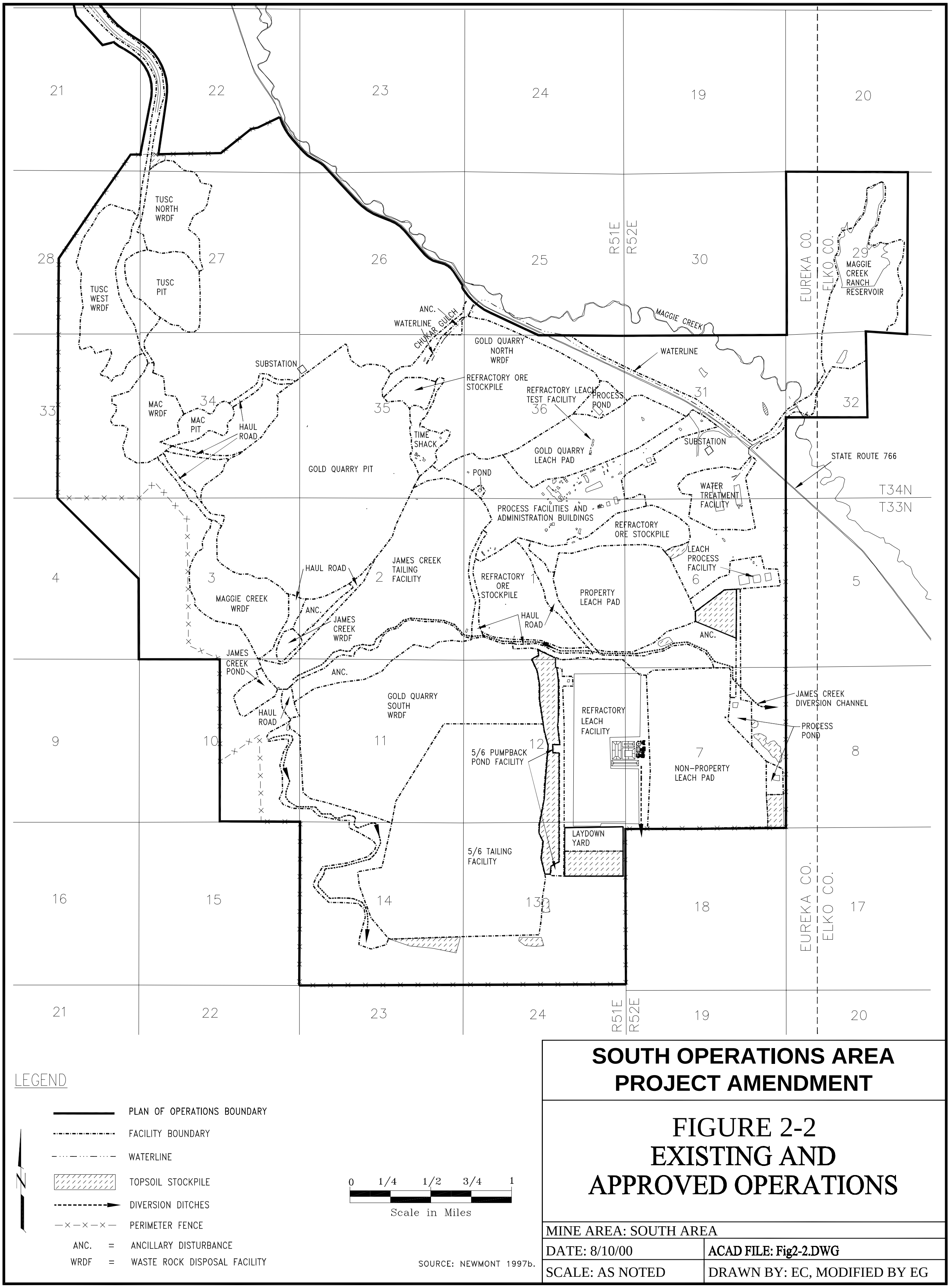
Mining begins with the recovery and stockpiling of available topsoil resources for future use in reclaiming disturbed areas. Ore and waste rock are then drilled and blasted in sequential benches to facilitate excavation, loading, and haulage. Rock samples, collected during blasthole drilling, are sent to Newmont's on-site analytical laboratory to determine metallurgical characteristics and gold grade. This information is used to supplement the original exploration data for both mine planning and operational control. Dependent upon metallurgical characteristics and gold grade, the blasted material can be sent to the oxide mill complex, refractory mill complex, oxide heap leach facilities, refractory leach facilities, refractory low grade ore stockpiles, or waste rock disposal areas.

Blasted ore and waste rock are loaded into large end-dump haul trucks, using either hydraulic shovels or front end loaders. The haul trucks deliver these materials to the designated location using a network of haul roads, both within and outside of the immediate open pit areas. Within the open pit mines, benches are established at approximately 25 foot vertical intervals. The width of each bench varies depending on whether the bench is in its final configuration or is to be used as a long-term working bench for roads and other activities. Haul trucks move within the open pit mine using temporary roads on the surface of each bench with ramps extending between two or more benches. Once the haul trucks leave the open pit mine, they travel on main haulage roads to deliver waste rock to the waste rock disposal areas and ore to Mills 5 and 6, heap leach pads, and stockpiles in the South Operations Area. These roads are bermed and maintained on a continuous basis to insure safe and efficient haulage operations and to minimize particulate dust emissions.

Gold Quarry Mine

The Gold Quarry Mine is an open pit mine in the South Operations Area with an historic production rate of approximately 83 million tons per year (tpy) of ore and waste rock. Under current approvals, the Gold Quarry Mine is projected to produce approximately 42 million tpy of ore and waste rock. The ratio of waste rock to ore is projected at 1.2:1. Under current approvals, the existing open pit mine extends approximately 7,500 feet northeast to southwest, 6,500 feet east to west, and approaches 1,455 feet in depth as measured from the pre-mining surface (the pit bottom elevation is approximately 3,375 feet above sea level).

Newmont operates dewatering wells in the South Operations Area to lower the groundwater table below the bottom of the Gold Quarry Mine. The South Operations Area Project EIS analyzed groundwater pumping rates of up to 42,000 gallons per minute (gpm) through year 2001 as approved by the Nevada Division of Environmental Protection (NDEP). Ore processing and dust



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 2-2
EXISTING AND APPROVED OPERATIONS

MINE AREA: SOUTH AREA	
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SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

control can consume up to 6,000 gpm of mine water. During the summer growing season, up to 5,500 gpm can be delivered to the T Lazy S Ranch lands for irrigation. The remaining water is treated and cooled, when necessary, to meet applicable permit effluent standards for discharge into Maggie Creek. Maggie Creek Ranch Reservoir is also used to store water during high flow periods in Maggie Creek and the Humboldt River.

Tusc Mine

The Tusc Mine is located 1.5 miles northwest of the Gold Quarry Mine. Permitted disturbance for the mine pit (500 feet deep), waste rock disposal facility (WRDF) and haul roads comprised 512 acres (BLM, 1993). The Tusc open pit mine is unaffected by this amendment.

Mac Mine

The Mac deposit is located 0.5 miles northwest of the Gold Quarry Mine. Permitted disturbance for the mine pit (400 feet deep), WRDF, and haul roads comprised 219 acres (BLM, 1993). The Mac open pit mine is unaffected by the proposed action, however, this pit will be analyzed for backfilling with waste rock from the Gold Quarry Mine.

South Operations Area Waste Rock Disposal Facilities

Up to 50 million tons of waste rock and overburden per year are generated by the South Operations Area mines. Waste rock is transported with haul trucks to the Gold Quarry North, Gold Quarry South, James Creek, Tusc, and Mac WRDFs. The waste rock is end-dumped down advancing, successive horizontal lifts, which vary in height from 10 to 100 feet. Slopes are established at the natural angle of repose. Each new lift on a waste rock facility is stepped back from the previous lift in order to facilitate reclamation and closure. Waste rock and overburden are also used as construction material for projects throughout the South Operations Area. The Maggie Creek WRDF is no longer active and has been reclaimed. The Tusc and Mac WRDFs will not be affected by the SOAPA.

South Operations Area Ore Processing Operations

The gold is associated with three basic ore types: oxide, sulfidic refractory and carbonaceous-sulfidic refractory. Oxide ore can be treated using industry standard cyanide extraction processes. The refractory ore typically requires pre-treatment to oxidize the ore prior to gold extraction; however, a portion of the low grade carbonaceous-sulfidic refractory ore will be leached directly with ammonium thiosulfate without pre-treatment. Ore processing facilities at the South Operations Area consist of Mills 5 and 6 and the Mill 5/6 tailing facility for high grade ore and leaching facilities for low grade ore. These facilities operate under authorization from the NDEP with the following Permit Numbers: Water Pollution Control Permit (NEV88011); Stormwater Discharge Permit (GNV0022225-10015); and Reclamation Permit (No. 0056).

Mill 5 - Oxide Ore Treatment Plant

The ore processing facilities at Mill 5 provide recovery of gold from high grade oxide ore through milling and cyanide extraction. The ore is hauled from the open pit mines to temporary stockpiles and blended for grade as it is fed into the primary crusher. The crushed ore is transferred to the Mill 5 feed stockpile.

Crushed ore is conveyed to the mill facility for further size reduction and dissolution of the submicroscopic gold in cyanide solution. Activated carbon, added to the process, selectively adsorbs the dissolved gold from solution. The gold-loaded carbon is periodically removed from the system and transferred to the carbon and refining facility to remove the gold from the carbon. Final gold recovery involves retorting to recover mercury, smelting with flux to remove residual impurities, and casting into dore bars. The tailing or finely ground rock residue remaining after gold recovery is pumped to the Mill 5/6 tailing facility. The design and management of Mill 5 will remain unchanged by the proposed action. Throughput capacity of the mill is approximately 20,000 tpd.

Mill 6 - Refractory Ore Treatment Plant

The ore processing facilities at Mill 6 provide recovery of gold from high grade refractory ore through milling, roasting, and cyanide extraction. Ore is hauled, directly either from the mines or from existing stockpiles, to Mill 6. The ore is blended for both grade and metallurgical characteristics as it is fed into the primary crusher. The crushed ore is conveyed to the drying and grinding circuit for further size reduction. Dried ore is heated at high temperatures in the roaster plant to oxidize the refractory ore. A separate gas cooling and cleaning system is utilized to collect process off-gases and remove impurities from the roasting circuit gas streams. The associated sulfuric acid plant converts sulfur oxides in the off-gas stream to a salable product. The roasted ore is cooled and mixed with water to form a slurry. The ore slurry is then amenable to cyanide extraction as described for Mill 5. The design and management of Mill 6 will remain unchanged by the proposed action. Daily throughput capacity for the mill is approximately 8,000 tpd at present and may be increased to its design maximum of 8,500 tpd.

Mill 5/6 Tailing Facility

Tailing generated by the milling processes at Mills 5 and 6 is pumped to the Mill 5/6 tailing facility for disposal. The Mill 5/6 tailing facility is designed as a zero discharge facility, with all process solution and stormwater inflows being returned to the process system, lost through evaporation, or retained within the facility as interstitial moisture in the tailing material. Adequate freeboard is designed into the system to contain normal fluid volumes in the pond plus runoff from the tailing facility resulting from the 100-year/24-hour design storm event. The Mill 5/6 tailing facility has enough existing permitted storage capacity to accommodate the tailing resulting from the SOAPA. The tailing facility encompasses 773 acres, with a final embankment height of 230 feet, and a total capacity of 67 million cubic yards. The design and management of the Mill 5/6 tailing facility will remain unchanged by the proposed action.

South Area Leach Facility

Oxide leach operations in the South Operations Area are conducted at the Property and Non-Property leach facilities; two separate leach pads. The Gold Quarry Leach Pad (185 acres) is in the beginning stages of closure. All existing leach pads are located on private lands. The leach pads were constructed by clearing and contouring the original land surface, placing a low permeability clay subgrade, installing a synthetic liner, and placing a layer of fine-grained material to protect the synthetic liner and a coarse rock layer to provide drainage at the base of the ore.

Leach grade ore is hauled from the mine to the leach pad or to the leach crushing facility for size reduction. During size reduction, the crushed ore is mixed with lime and Portland cement or other agglomerating agents and water to agglomerate the fine ore particles. The ore is hauled to active leach areas on the South Area Leach Property (294 acres) and Non-Property leach pads (397 acres) and is dumped and spread on the leach pads in successive lifts approximately 30 feet high. Cyanide solution is applied to the uppermost lifts by continuous drip emitters or sprinklers, leaching both the newly added ore and the ore with residual gold contained in the underlying lifts. The leach pads drain to central collection points on the synthetic-lined pads where the solution flows into a lined pond. The solution is then pumped to a series of activated carbon columns. The gold-loaded carbon is periodically removed and sent to the carbon and refining facility to recover the gold.

Refractory Leach Facility

The current Plan of Operations authorizes construction of a production-scale Refractory Leach Facility, which would encompass 346 acres. Newmont recently (January 2000) completed constructing the Refractory Leach Facility. Depending on specific metallurgical characteristics, refractory ore will be processed using biooxidation, ammonium thiosulfate leaching and/or cyanide leaching. Facilities under construction include biooxidation and ammonium thiosulfate leach pads.

South Operations Area Ancillary Facilities

The ancillary facilities and infrastructure of the South Operations Area (2,053 acres) include access and haul roads; power distribution systems; processing facilities; mining and equipment maintenance shops; fueling areas; administrative offices; and dewatering and monitoring wells.

Facilities within the South Operations Area complex are linked by pipeline systems for distribution of potable water, mine water, ore processing solution, and tailing.

Water diversion ditches and channels within the South Operations Area divert surface water around the open pit mines, the Mill 5/6 and James Creek tailing facilities, leach facilities, and waste rock disposal facilities.

Existing Resource Monitoring

Air Quality

Newmont must sample ambient air for particulates 10 microns or smaller (PM-10) and monitor and record meteorological conditions at the sampling site as specified by the NDEP, Bureau of Air Quality. Emissions of concern (particulates, oxides of nitrogen, sulfur dioxide, and carbon monoxide) from existing operations are reduced through use of Best Management Practices (Handbook of Best Management Practices, Nevada State Conservation Commission, 1994). Examples include direct water application, the use of approved chemical binders or wetting agents, and revegetation of disturbed areas concurrent with operations. Sampling and monitoring have been conducted at the South Operations Area and will continue until active mining is complete. Findings are reported to the NDEP, Bureau of Air Quality within 60 days of the end of each quarter of the calendar year.

Air quality levels at the South Operations Area currently meet Nevada and federal standards.

Water Resources

Water resources in and around the South Operations Area are monitored within three hydrologic basins: Maggie Creek, Marys Creek, and Susie Creek. The current monitoring program addresses groundwater and surface water, including springs and seeps. Water quality and flows are measured routinely by Newmont at designated monitoring wells and surface water stations. Additional details on the hydrologic monitoring program at the South Operations Area are included in the Final EIS for the previous Plan of Operations Amendment (BLM, 1993). If impacts to water resources are observed in this area as a result of dewatering operations, a mitigation plan has been prepared and will be implemented (South Operations Area Project Mitigation Plan, BLM 1993). The South Operations Area Project Mitigation Plan (BLM, 1993) was prepared and will continue to be implemented if impacts to water resources are observed occurring as a result of the mining and processing activities and dewatering operations analyzed in the final EIS and approved for the 1992 plan of operations. Numerous mitigation measures in the 1993 mitigation plan have been implemented. Implementation of the Maggie Creek Watershed Restoration Project has provided and continues to provide benefits to water resources, riparian areas and wetlands, and livestock pastures (BLM, 2000a). Please see **Appendix A** for more information (1999 Progress Report for the SOAP Mitigation Plan Implementation, Riparian Monitoring Analysis - Maggie Creek Watershed Restoration Project, and photographs of Maggie and Coyote Creeks before and after restoration efforts).

Newmont has a permit issued by the NDEP to discharge groundwater to Maggie Creek (up to 50,000 gpm). The water is cooled, monitored for quality and, when necessary, treated to remove naturally-occurring arsenic. These data are reported in the Discharge Monitoring Reports for NPDES permit No. 0022268 which are available for inspection at NDEP. **Table 2-1a presents a summary of discharge water quality for the period 1994-1998.**

Newmont has obtained a stormwater permit that regulates stormwater discharges from its facilities. Best Management Practices, developed by the Nevada State Conservation Commission, are used to control stormwater discharges. These include material handling practices that minimize the exposure of pollutants to stormwater; spill prevention and response; sediment and erosion control; and physical stormwater controls. Pursuant to applicable regulations, surface water diversion ditches will be constructed around the final perimeter of the pits and waste rock disposal facilities to prevent runoff from and run-on to these facilities.

Potentially Acid-Producing Rock

Newmont continues to sample, test, and classify the waste rock, in accordance with the NDEP Waste Rock and Overburden Evaluation guideline, to determine the potential of the mined waste rock to generate acid. Monitoring of stockpiled ore and waste rock with acid-producing potential is required by the NDEP. Site-specific plans are addressed in Newmont's "Refractory Ore Stockpile and Waste Rock Dump Design, Construction, and Monitoring Plan." These guidelines were developed to manage potential acid rock drainage through control of the acid generation process. Potentially acid generating waste rock that is identified is segregated, encapsulated, and monitored in accordance with the Plan.

TABLE 2-1a
SUMMARY OF NEWMONT DISCHARGE WATER QUALITY

Total Concentration Statistics[1,2,3]	TDS mg/l	TSS mg/l	Turb NTU	As mg/l	Cd mg/l	Fe mg/l	Hg mg/l	Mn mg/l	Se mg/l
No. of Samples	61	52	59	180	180	180	180	181	180
Minimum	52	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Average	354	4.0	0.66	0.026	0.001	0.047	0.0001	0.005	0.002
Maximum	695	25.3	5.19	0.250	0.008	0.700	0.0020	0.073	0.007
No. above Detection Limit	61	37	55	179	13	102	7	114	54
No. above NDEP Standard[4]	30	2	0	2	10	0	7	0	6
Maximum Detection Limit	NR	10	0.05	0.002	0.005	0.1	0.002	0.005	0.005
HUM-5 pre-discharge avg.[5]	314	86.5	30.21	0.008	0.003	2.31	0.0002	0.11	0.003
Maggie Creek upstream avg.[6]	309	22.0	10.55	0.012	0.001	0.581	0.0001	0.042	0.002
NDEP Permit 30-day avg.	350	20.0	20.00	0.050	0.002	1.0	0.000012	0.1	0.005
NDEP Permit Daily Max	400	30.0	50.00	0.050	0.009	1.0	0.0024	0.1	0.020

Source: Newmont, 1999; NDEP 1994.

[1] Samples from 1994 through 1998 for discharge above outfall.

[2] Average values were calculated assuming half detection limit for values below detection limit.

[3] Samples collected generally weekly;TDS = total dissolved solids; TSS = total suspended solids;Turb. = turbidity; As = arsenic; Cd = cadmium; Fe = iron; Hg = mercury; Mn = manganese; Se = selenium; mg/l = milligrams per liter; NTU = nephelometric turbidity units; bdl = below detection limits.

[4] Based on 30-day average standard

[5] Humboldt River at Palisade Control Point; Average from 1990 through March 1994, beforge discharge into Maggie Creek started.

[6] Location b in NDEP permit, 3 meter upstream from outfall

The integrity of the facilities is routinely checked for the following conditions: drainage from the facility, unusual ponding in the collection ditches, precipitates or staining on or down stream of the waste rock dump facilities, or slope failures and exposure of potentially acid-generating wastes.

Newmont has developed an intensive program designed to identify sources of potentially acid generating rock before they are removed during mining operations. This allows the planned mining of the rock and its placement in specially-prepared areas. These specific stockpiles and disposal areas are designed to prevent vertical migration of water and to contain lateral surface flows off the piles. Any drainage from these facilities is captured and used in the ore processing circuits. Ditches and berms are inspected quarterly and the stockpiles and disposal areas are inspected when flood conditions exist or have occurred. At closure, the potentially acid-generating rock would be totally capped to preclude drainage.

Hazardous Substances

The term “hazardous substance” is defined in 40 CFR 302.4 and the Superfund Amendments and Reauthorization Act (SARA) Title III (40 CFR 355). Hazardous substances are defined in 40 CFR 302 as “elements and compounds and hazardous wastes appearing in Table 302.4 are designated as hazardous substances under the Act.” The Act is CERCLA or Superfund - Comprehensive Environmental Response, Compensation and Liability Act of 1980. Hazardous wastes are defined in 40 CFR 261. Hazardous substances that are transported, stored, or used onsite in quantities greater than the Threshold Planning Quantity designated by SARA Title III for emergency planning, are summarized in **Table 2-2**. Hazardous substances are transported to the South Operations Area by U.S. Department of Transportation regulated transporters (49 CFR 172) and stored onsite in approved containers (Newmont, 1997b). Spill containment structures are provided for storage containers. All hazardous substances are stored on private land.

The following hazardous substances may be transported, stored, and used at the South Operations Area in quantities less than the threshold designated by SARA Title III for emergency planning. The threshold for these substances is 10,000 pounds (BLM, 1993).

Acetone
Ammonium thiosulfate (5000 lbs)
Gasoline
Potassium permanganate
Ammonium hydroxide
Lead acetate
Sodium hydroxide solution
Calcium hypochlorite
Methyl ethyl ketone
Sodium hypochlorite
Mercury
Methyl chloroform
Solid sodium hydroxide
Freon
Methyl isobutyl ketone
Toluene

This list was derived from information provided by Newmont (1997c). Small quantities of hazardous substances not included in the above list may also be managed at the South Operations Area. These substances are components of commercially-produced paints, office products, and automotive maintenance products.

Hazardous Waste

The South Operations Area currently operates as a Large Quantity Generator of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). A RCRA Large Quantity Generator is a facility that generates more than 1,000 kilograms per month of RCRA-regulated hazardous waste (40 CFR Part 262). RCRA- regulated hazardous wastes generated at the South Operations Area and in associated management practices are included in **Table 2-3**.

TABLE 2-2
HAZARDOUS SUBSTANCES MANAGEMENT

Substance	Rate of Use	TPQ[1] (pounds)	Use	Amount Stored (typical)	Storage Method	Waste Management
Ammonium thiosulfate	7,058,500 lbs/year	NA	Oxidizing Ore	41,975 pounds	Bulk Tank	Consumed and converted by use
Sodium cyanide	4,800,000 lbs/year	100	Gold recovery process	400,000 pounds	Bulk tank solid	Portions are recycled or neutralized and left in place
Sulfuric acid	134,467,000 lbs/year produced by roaster	1,000	2 percent used in refinery acid digestion process	35,400 pounds	Bulk tank	Sold to 3rd parties off site
Hydrochloric acid	1,456,000 lbs/year	NA	Mill processing	47,800 pounds	Bulk tank	Returned to processing circuit
Hydrochloric acid	4,000 lbs/year	NA	Assay laboratory	218 pounds	One-gallon bottles	Returned to processing circuit
Nitric acid	660 lbs/year	1,000	Assay laboratory	100 pounds	One-gallon bottles	Returned to processing circuit
Diesel fuel	900,000 gal/month	NA	Equipment fuel	754,000 pounds	Bulk tanks	Spill containment

Source: Newmont, 1997b and 1999a.
1 TPQ = hazardous substance Threshold Planning Quantity designated by SARA, Title III (40 CFR 355).
NA = Not Applicable

TABLE 2-3
HAZARDOUS WASTE STREAMS[1]

Stream	Generator	EPA Hazardous Waste Code	TSDF[2]	Generation Rate[3] (pounds/year)
Paint-related materials	Mill 6	D001, F003	**Safety Kleen**/Grassy Mt. by Incineration	4,000
Mercury PPE/debris[4]	Mill 6	D009	**Safety Kleen**/Grassy Mt. by HW Landfill[5]	2,800
Spent MIBK[6]	Assay Lab	D001, D002	**Safety Kleen**/Grassy Mt. by Incineration	350
Mercuric/Mercurous Chloride	Mill 6	D009, D002	**Air Pollution Control on Roaster** in HW Landfill	42,000
Mercury Solids	Mill 6	D009	**Safety Kleen**/Phoenix by HW Landfill	4,000
Solvents	Mills, Leach	D001, F003	**Safety Kleen**/Grassy Mt. by Incineration	8,000
Hydrochloric, Sulfuric Acid	Mills, Refinery	D002	**Safety Kleen**/Grassy Mt. by Incineration	5,000
Caustic Solutions	Mills	D002	**Safety Kleen**/Grassy Mt. by HW Landfill	2,000
Lab Packs[7]	Mills, Lab	varies	**Safety Kleen**/Phoenix; varies	500
Lead-Bearing Waste	Assay Lab	D008	**Safety Kleen**/ Grassy Mt. by Incineration	256,000
Halogenated Oil	Mills	F002	Aragonite Aptus by Incineration	3,000
Vanadium pentoxide Catalyst	Mill 6	D009	**Safety Kleen**/Grassy Mt. by Incineration	25,640

1 Source: Newmont, 1997c.
2 TSDF: Treatment, Storage, or Disposal Facility.
3 Rate in 1997.
4 Personal Protection Equipment
5 Hazardous Waste Landfill.
6 Methyl Isobutyl Ketone.
7 Laboratory Clean-Out Chemical Wastes.

All hazardous wastes currently generated by Newmont are handled according to existing, approved permits or are being disposed of according to local, state, or federalregulations.

Toxics Release Inventory (TRI)

In 1999, Newmont reported total releases of over 107 million pounds of materials to the air, water, and land from the South Operations Area. Approximately 99.8 percent of that total was associated with the waste rock placed in waste rock disposal facilities and tailing placed in the tailing impoundment. Table 2-3a presents more information about these releases. The table does not show that over 8,000 pounds per year of sulfuric acid are captured and sold as a byproduct, and approximately 448 pounds per year of mercury compounds are transferred off-site to be recycled. With the exceptions of ammonia, chlorine, hydrogen cyanide, and propylene, all the items listed are naturally occurring elements or compounds in the earth's crust. The release information reflects the operation of mining large volumes of rock with the compounds inherent in the rock, and then disposing of those materials on site. The largest volumes reported to TRI are for "Other Disposals" (i.e., those compounds bound in the rock that report to the waste rock disposal facilities). The closure procedures for the waste rock facilities will stabilize, cover, and revegetate the facilities and prevent leaching of these compounds into the environment. The next largest volume of releases are those reporting to the tailing impoundment. After closure, ultimate drying, and final reclamation, the tailing impoundment will not leach materials into the environment.

Mercury is a common element in the rocks that are being mined at the SOAPA and is of concern because it is a persistent, bioaccumulative element. Newmont is considered by the EPA to manufacture mercury because it is recovered and sold as a byproduct of the ore processing. The waste rock containing mercury that Newmont places in the waste rock disposal facilities on site is considered a release to the environment for TRI reporting purposes. Other releases of mercury from site facilities are as follows: Fugitive air emissions associated with fugitive dust particles total 29 pounds per year, roaster stack emissions total 50 pounds per year, mercury in the spent ore that reports to the tailing impoundment totals 110,000 pounds per year, and mercury bound in waste rock placed in waste rock disposal facilities totals 120,000 pounds per year. The numbers refer to a 1 year report (1998) and assumes a constant rate of production. At an average rate of production, 31,400,000 tons of waste rock would be produced annually. The mercury in that volume of rock would constitute 0.00019% by weight.

Solid Wastes

Newmont has an approved solid waste permit from NDEP, called a Class III Waiver, (Application #SWMI-07-18) for disposal of nonhazardous solid waste in their own landfill on site.

Some solid, nonhazardous wastes are transported to the Elko and Eureka County landfills.

TABLE 2-3a
REVISED 1998 TOXICS RELEASE INVENTORY - CARLIN SOUTH AREA MINE SITE

CAS Number	Chemical	Air Emissions (pounds)	Surface Water Discharges (pounds)	On-site Land Releases (pounds)	Total On-site Releases [Air + Water + Land] (pounds)	Total Transfers Off-site to Disposal (pounds)	On- and Off-site Releases (pounds)
7664-41-7	Ammonia	118,260	0	45,000	163,260	0	163,260
--	Antimony compounds	286	15	1,630,002	1,630,303	NA	1,630,303
--	Arsenic compounds	14,450	1,300	49,000,200	49,015,950	0	49,015,950
--	Cadmium compounds	74	66	560,000	560,140	0	560,140
7782-50-5	Chlorine	5	NA	0	5	NA	5
7440-47-3	Chromium	75	0	390,270	390,345	1	390,346
--	Cobalt compounds	66	0	980,092	980,158	0	980,158
--	Copper compounds	691	0	3,710,003	3,710,694	0	3,710,694
--	Cyanide compounds	0	0	7,500	7,500	0	7,500
74-90-8	Hydrogen cyanide	27,180	NA	NA	27,180	NA	27,180
--	Lead compounds	91	0	670,003	670,094	0	670,094
--	Manganese compound	4,695	170	22,400,153	22,405,018	0	22,405,018
--	Mercury compounds	82	0	230,000	230,082	0	230,082
--	Nickel compounds	570	0	3,300,180	3,300,750	0	3,300,750
--	Nitrate compounds	0	5,400	110,180	115,580	0	115,580
115-07-1	Propylene	3,700	NA	0	3,700	0	3,700
--	Selenium compounds	29	65	159,003	159,097	0	159,097
	Silver compounds	12	0	47,560	47,572	0	47,572
--	Sulfuric acid aerosols	34	NA	0	34	NA	34
--	Thallium compounds	650	0	2,890,000	2,890,650	0	2,890,650
--	Zinc compounds	3,823	72	21,000,299	21,004,194	0	21,004,194
	Total of all Carlin South Area TRI Releases						***107,312,307***
	Total Relases to Air/Water/Land	***174,773***	***7,088***	***107,130,145***		***1***	
	Percentage of Total TRI Releases	***0.16***	***0.01***	***9.83***		***0***	***100***
	1998 Release	***173,883***	***7,088***	***107,130,445***		***1***	***107,311,417***
	Difference	***890***	***0***	***0***		***0***	***890***

Source: Newmont Mining Corporation, 2001. Newmont Mining Carlin South Area 1998 and 1999 TRI Calculations Comparison. Report submitted to Newmont by JBR Consultants, Inc., January 2001.

Tailing Composition

The Mill 5/6 complex generates approximately 30,000 tpd of tailing, which is pumped via slurry pipeline to the Mill 5/6 Tailing Storage Facility. **Table 2-4** presents pH, metal, and cyanide concentrations in the South Operations Area tailing. These values are based on an average of metal concentrations for the Mill 5/6 solid tailing and average cyanide concentrations and pH values for the Mill 5/6 liquid tailing during 1996 (Newmont, 1997c).

Human Health and Safety

The South Operations Area is subject to the Federal Mine Safety and Health Act of 1977 which sets forth mandatory safety and health standards for surface metal and nonmetal mines, including open-pit mines. The purpose of these standards is the protection of life, promotion of health and safety, and prevention of accidents. Regulations promulgated under the act are codified under 30 CFR Subchapter N, Part 56. New employees at the South Operations Area are required by Newmont to receive training for specific tasks, for hazards, and to receive yearly refresher training.

Employment

Newmont presently employs approximately 2,950 people in Nevada; approximately 1,000 people at the South Operations Area Project.

Reclamation

Newmont filed a reclamation plan and amendments addressing mining activities in the South Operations Area (Newmont, 1992, 1996, 1997b, 1997d). This reclamation plan encompasses all existing disturbances in the South Operations Area. An amendment to that Plan, which addresses the Proposed Action, is discussed in the next section of this chapter.

PROPOSED ACTION

General Project Overview

The overview of project facilities and operations is summarized from the proposed Plan of Operations amendment filed by Newmont in 1997. The Plan of Operations contains detailed information on facilities, processes, and operations. This document is available for review at the Elko Field Office of the Bureau of Land Management.

The primary component of the SOAPA is the continued mining of the Gold Quarry ore body to recover both refractory and oxide gold ores. The Gold Quarry Mine would be expanded laterally and at depth. Proposed mining operations under the SOAPA would continue through the year 2011, and employment would remain at approximately 1,000 people.

The Gold Quarry Mine operations would require the continuation of mine dewatering activities for the life of the project. During the period of proposed mining, dewatering would continue at flow rates lower than those analyzed in the South Operations Area Project EIS (BLM, 1993) (maximum 42,000 gpm). Water treatment (if necessary), cooling, and discharge to Maggie Creek would continue.

The South Operations Area has seven WRDFs. The existing Gold Quarry North, Gold Quarry South, and James Creek WRDFs would be increased both laterally and vertically to provide capacity for the waste rock from the continued mining of the Gold Quarry Mine. The James Creek WRDF would encroach on land previously disturbed by the

TABLE 2-4
CONCENTRATIONS[1] OF TRACE ELEMENTS IN MILL TAILING

Solids				Liquids	
Parameter	**µg/g[2] (ppm)[3]**	**Parameter**	**µg/g (ppm)**	**Parameter**	**mg/L[4] (ppm)**
Arsenic	230	Sodium	300	pH (pH units)	8.55
Antimony	220	Thallium	11	Specific Conductance (µmhos/cm)	4,800
Barium	2,120	Strontium	330	Cyanide, WAD[5]	34.5
Beryllium	8	Tin	6	Cyanide, Free	18.3
Boron	31	Titanium	400	Cyanide, Total	47.8
Cadmium	4.7	Vanadium	900		
Chromium	65	Zinc	120		
Cobalt	3.8	Mercury	1.5		
Copper	65	Uranium	10		
Lead	90	Thorium	13		
Magnesium	170	Gold	3.0		
Manganese	33	Chloride	11		
Molybdenum	48	Tungsten	14		
Nickel	81	Lithium	6.2		
Silver	5.2	Hafnium	10		
Selenium	240	Lutetium	0.47		
Thulium	0.67	Ytterbium	3.8		

Source: BLM, 1993.
1 Concentrations are based on the average concentration of trace elements in Mill 5/6 tailing.
2 µg/g = micrograms per gram (solids measurement unit).
3 ppm = parts per million.
4 mg/L = milligrams per liter (liquid measurement unit).
5 WAD = weak acid dissociable cyanide.

Maggie Creek WRDF. Approximately 10 percent of waste rock is used for construction projects in the South Operations Area (primarily non-acid generating material). The Tusc and Mac WRDFs will be unaffected by the proposed amendment.

High grade oxide ores produced from the Gold Quarry Mine would be processed at Newmont's existing Mill 5 through 1999. High grade refractory ores would be processed at Newmont's existing Mill 6. The existing Mill 5/6 tailing facility is adequately sized to accommodate the additional tailing from the Proposed Action.

Low grade oxide and refractory ore would require expansions to Newmont's South Area Leach processing facilities. Newmont would enlarge the Non-Property Leach Pad and Refractory Leach Pad and construct the Property Leach Pad 2 to process the Gold Quarry Mine low grade ore. **Table 2-5** presents predicted and past production rates.

An overview of the South Operations Area facilities including the proposed action is provided on **Figure 2-3**. Existing South Operations Area Project facilities are described earlier in Chapter 2.

TABLE 2-5
PRODUCTION RATES (TONS)

	Material Type					
	Oxide Mill	Refractory Mill	Oxide Leach	Refractory Leach	Waste Rock	Total Material
Year 1	7,000	0	899,000	3,000	15,197,000	16,106,000
Year 2	147,000	0	2,888,000	60,000	36,899,000	39,994,000
Year 3	490,000	19,000	3,564,000	3,833,000	43,084,000	50,990,000
Year 4	1,791,000	37,000	1,386,000	3,220,000	43,117,000	49,551,000
Year 5	703,000	38,000	2,684,000	1,606,000	44,132,000	49,163,000
Year 6	425,000	24,000	5,136,000	2,047,000	40,832,000	48,464,000
Year 7	529,000	208,000	5,109,000	5,791,000	36,732,000	48,369,000
Year 8	1,349,000	91,000	7,312,000	7,335,000	31,510,000	47,597,000
Year 9	1,725,000	516,000	7,645,000	9,776,000	27,755,000	47,417,000
Year 10	689,000	1,369,000	4,394,000	9,816,000	30,928,000	47,196,000
Year 11	284,000	725,000	930,000	5,590,000	34,667,000	42,196,000
Year 12	76,000	861,000	75,000	10,204,000	16,949,000	28,165,000
Year 13	0	2,960,000	3,000	2,133,000	6,169,000	11,265,000
Total	8,215,000	6,848,000	42,025,000	61,414,000	407,971,000	526,473,000

Source: Newmont, 1997d.

Status of Lands Affected by Proposed Activities

Newmont seeks BLM approval for future activities in the South Operations Area that involve the use of public domain lands. These activities, which occur on both public and private lands, are discussed in detail below, including:

1. Continued mining of the Gold Quarry Mine;
2. Expansion of the Gold Quarry North, Gold Quarry South, and James Creek waste rock disposal facilities;
3. Expansion of the South Area Leach Facility;
4. Expansion of the Refractory Leach Facility; and
5. Construction of ancillary facilities.

These proposed activities would result in an incremental surface disturbance of 839 acres of public land, as shown in **Table 2-6**. **Table 2-7** presents the total surface disturbance with the amendment to the Plan of Operations.

The proposed operations are described in the following sub-sections, and shown in **Figure 2-3**. The proposed South Operation Area Project facilities have been designed to comply with all applicable provisions of the Nevada Administrative Code, Regulation Governing Design, Construction, Operation and Closure of Mining Operations (NAC 445A.350-445A.447), and other applicable state and federal regulations. Newmont will apply to the NDEP for authorization to modify, as necessary, the existing Water Pollution Control Permit (NEV88011), Stormwater Discharge Permit (GNV0022225-10015), and Reclamation Permit (No. 0056) to

TABLE 2-6
PROPOSED SURFACE DISTURBANCE

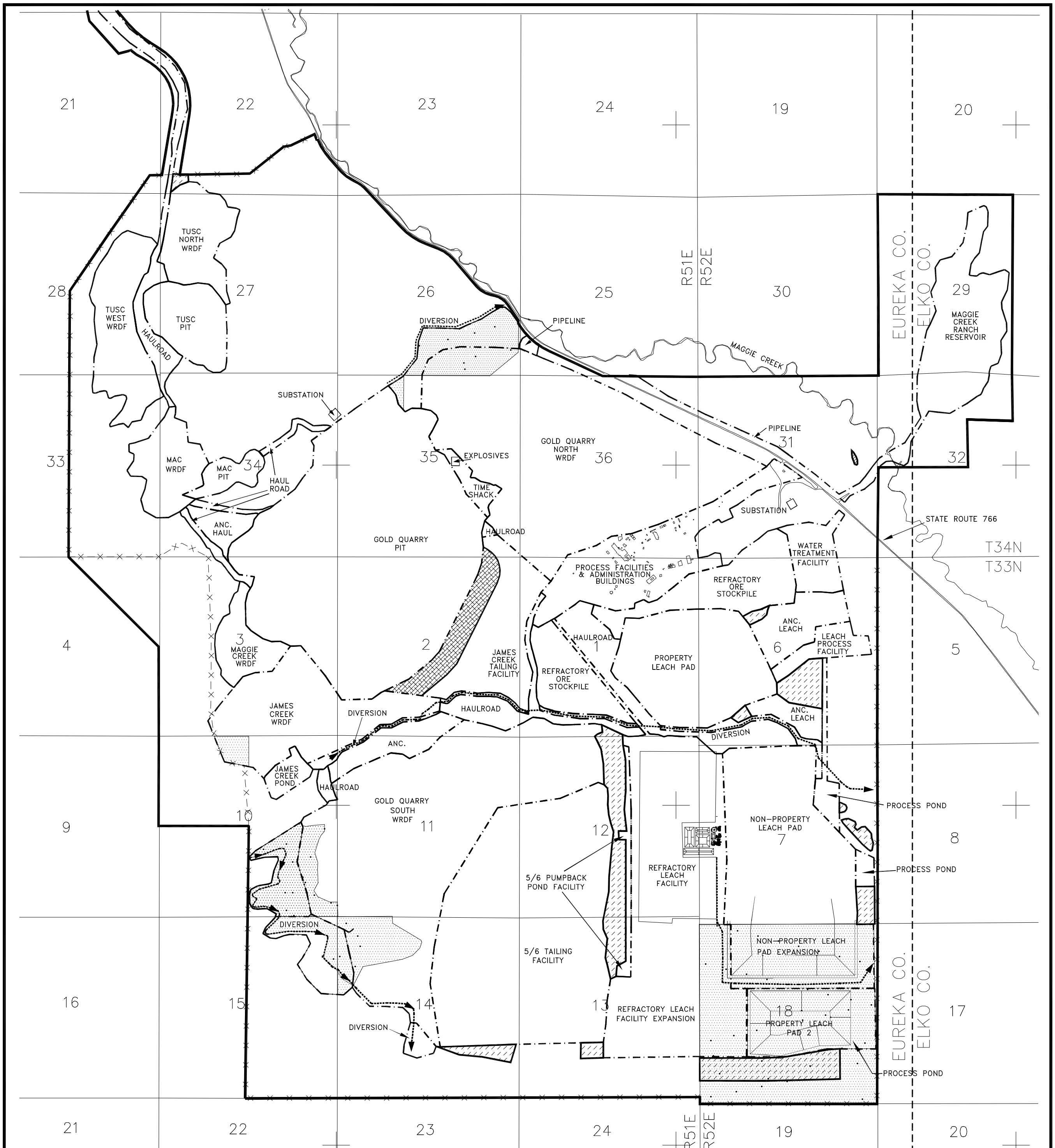
Facility	Disturbance Acreage		
	Public	Private	Total
Gold Quarry Mine	9	130	139
Tusc Mine	0	0	0
Mac Mine	0	0	0
Haulage Roads	-3	62	59
Dewatering Facilities	-8	-32	-40
Waste Rock Disposal Facilities			
Gold Quarry North WRDF	57	382	439
Gold Quarry South WRDF	205	30	235
Maggie Creek WRDF	0	-82	-82
James Creek WRDF	0	255	255
Tusc West WRDF	0	0	0
Tusc North WRDF	0	0	0
Mac WRDF	0	0	0
Processing Facilities	0	0	0
Ore Stockpiles	-5	-33	-38
Leaching Facilities			
Gold Quarry Leach Pad	0	-185	-185
Property Leach Pad	0	0	0
Property Leach Pad 2	163	0	163
Non-Property Leach Pad	182	0	182
Refractory Leach Pad	108	219	327
Tailing Facilities			
James Creek tailing facility	-7	-179	-186
Mill 5/6 tailing facility	0	0	0
Diversion Channels	54	84	138
Topsoil Stockpiles	116	82	198
Ancillary Facilities	-11	-179	-190
Geologic Evaluations	-21	-1	-22
Total Disturbance Acreage	839	553	1,392

Source: Newmont, 1997d.
Note: Negative values are derived from existing disturbance that is incorporated into the proposed disturbance.

TABLE 2-7
TOTAL SURFACE DISTURBANCE

Facility	Disturbance Acreage		
	Public	Private	Total
Gold Quarry Mine	248	752	1,000
Tusc Mine	93	22	115
Mac Mine	43	0	43
Haulage Roads	138	390	528
Dewatering Facilities	0	353	353
Waste Rock Disposal Facilities			
Gold Quarry North WRDF	57	789	846
Gold Quarry South WRDF	323	540	863
Maggie Creek WRDF	0	71	71
James Creek WRDF	0	268	268
Tusc West WRDF	154	20	174
Tusc North WRDF	11	110	121
Mac WRDF	105	0	105
Processing Facilities	0	244	244
Ore Stockpile Areas	0	257	257
Leaching Facilities			
Gold Quarry Leach Pad	--	--	--
Property Leach Pad	0	294	294
Property Leach Pad 2	163	0	163
Non-Property Leach Pad	182	397	579
Refractory Leach Pad	351	322	673
Tailing Facilities			
James Creek tailing facility	0	251	251
Mill 5/6 tailing facility	436	337	773
Diversion Channels	167	123	290
Topsoil Stockpiles	145	170	315
Ancillary Facilities	103	654	757
Geologic Evaluations	167	102	269
Total Disturbance Acreage	2,886	6,466	9,352

Source: Newmont, 1997b.



LEGEND

- PLAN OF OPERATIONS BOUNDARY
- FACILITY BOUNDARY
- PERIMETER FENCE
- TOPSOIL STOCKPILE
- PROPOSED OPERATIONS ON PUBLIC LAND
- DIVERSION DITCHES
- GOLD QUARRY PIT EXPANSION AREA WHERE JAMES CREEK TAILING WOULD BE REMOVED

ANC. = ANCILLARY DISTURBANCE

WRDF = WASTE ROCK DISPOSAL FACILITY

0 1/4 1/2 3/4 1

Scale in Miles

SOURCE: NEWMONT 1997b.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 2-3
PROPOSED OPERATIONS

MINE AREA: SOUTH AREA	
DATE: 8/10/00	ACAD FILE: Fig2-3.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

begin operations. The existing mine water discharge permit (NEV0022268) would not require any modification as a result of this proposal.

Gold Quarry Mine

Both oxide and refractory gold ore would be mined concurrently from the Gold Quarry Mine. The continuation of mining would involve the removal of approximately 526 million tons of ore and waste rock over a 13-year period. Mining operations in the Gold Quarry Mine would generally involve the same operating practices currently utilized and described earlier in this chapter.

Proposed mining operations would increase the depth of the currently permitted Gold Quarry Mine by 350 feet to the 3,725-foot elevation. The pit expansion would occur along the eastern and southern perimeter. Dimensions from north to south would increase by approximately 800 feet to a total dimension of 7,500 feet. The SOAPA would encroach on 9 acres of public domain lands and 130 acres of private lands. Additional disturbance associated with the mine expansion would occur at the existing James Creek tailing facility, haul roads, and ancillary facilities. General acreages, dimensions, and capacities of facilities are presented in **Table 2-8**.

Additional haulage roads and extensions to existing roads are required to connect the Gold Quarry Mine to the waste rock disposal and ore processing facilities. Typical haulage roads would be approximately 200-feet wide. The haul road to the James Creek WRDF would be relocated after the tailing in the James Creek tailing facility are moved. The new haul road would be south of, and parallel to, the southern perimeter of the pit.

The proposed open pit expansion would require relocating 30 million tons of tailing from the James Creek tailing facility to the Mill 5/6 tailing facility. The existing Mill 5/6 tailing facility has adequate permitted capacity to contain this amount of tailing. Dredging has been determined to be the most efficient method of moving the tailing. Conventional surface mining techniques may also be used to move drier tailing on the periphery of the impoundment. Newmont would move the tailing material, over a period of 3 years, to create a geotechnically stable slope angle in the remaining tailing. The toe of the tailing slope would be established outside the crest of the open pit. An embankment along the common boundary with the Gold Quarry Mine would be constructed from mine waste rock and would have a compacted clay liner on the upstream (tailing-side) face. The embankment would not buttress the remaining tailing in the James Creek tailing facility, but would be designed to contain potential movement of tailing resulting from a seismic event. The embankment would be designed and constructed to withstand the maximum horizontal acceleration from seismic events as described in **Chapter 3**.

Mining of the Gold Quarry Mine would require the continuation of dewatering operations beyond year 2001 to keep the water table below the mine floor. Dewatering pumping rates of less than 30,000 gpm are forecasted during the life of the proposed project. Following completion of the Gold Quarry mining operations, pumping rates would continue for approximately 5 years, at a rate of 2,500 gpm, to support process operations.

TABLE 2-8
ACREAGE, DIMENSIONS, AND CAPACITIES FOR SOAPA FACILITIES AT END OF MINING

Facility	Acreage	Dimensions (feet) length x width x height[1]	Approximate Capacity (million tons)
Gold Quarry pit	1,000	7300 x 7500 x 1805 deep	---
Gold Quarry North WRDF	846	4000 x 4200 x 400	496
Gold Quarry South WRDF	863	1900 x 5050 x 200	217
Maggie Creek WRDF	71	2250 x 2600 x 120	30.5
James Creek WRDF	268	2000 x 3800 x 200	115
Ore Stockpiles	257	multiple	variable
Property Leach pad	294	3000 x 4000 x 200	118
Property Leach pad 2	163	2075 x 3125 x 300	46
Non-property Leach pad	579	6700 x 3700 x 300	245
Refractory Leach pad	673	3450 x 3550 x 100	61.4
Mill 5/6 tailing facility	773	4500 x 6750 x 125	67 million cubic yards
Diversion Channels	138	11,750 x 50	---
Topsoil Stockpiles	315	multiple <20 ft high	5.5 million cubic yards

Source: Newmont, 1997d.
[1] Average height above native ground surface. Length and widths are maximum but most facilities are irregularly shaped.

Projected mine dewatering flow rates are based on results of a finite-element hydrologic model (HCI, 1999). The model used to support the SOAPA is based on the expansion and evolution of the original model used to support the South Operations Area Project EIS (BLM, 1993). Documentation of the final model can be found in HCI **(**1992**)**.

South Operations Area Waste Rock Disposal Facilities

The design criteria used to ensure stability of the project facilities are described in NDEP (1996). Waste rock disposal facilities, the new berm along the common boundary of the pit and the James Creek tailing facility, leach pads, and mine pit slopes were designed in accordance with NDEP specifications for wet climate cycles, storm conditions, and earthquakes. Therefore, these facilities should have long-term stability following closure and reclamation.

The SOAPA is expected to generate approximately 408 million tons of waste rock. Based on the proportions of oxide and refractory ore produced, approximately 42 percent of the waste rock would be oxide and 58 percent refractory. The Gold Quarry North, Gold Quarry South, and James Creek WRDFs would be expanded to accommodate this additional waste rock.

The Gold Quarry North and South WRDFs are designed to accommodate potential acid generating waste rock produced by the Gold Quarry Mine expansion. Design guidelines, approved by the NDEP, are presented within Newmont’s Refractory Ore Stockpile and

Waste Rock Dump Design, Construction, and Monitoring Plan, as submitted to the NDEP and BLM (see Reclamation section above).

Monitoring of these facilities would be conducted as follows during operations and during the reclamation and closure. A quarterly inspection of refractory ore stockpiles and waste rock disposal facilities would be conducted to detect any possible abnormal conditions and to ensure the integrity of the ditches and berms. Diversion ditches around WRDF perimeters would be examined for indications of erosion or obstructions and any deficiencies would be corrected.

Refractory ore stockpiles and waste rock dump facilities would also be inspected following periods of heavy spring snow melt or a precipitation event with the potential for run-off. The purpose of inspection is to monitor the functioning of the facilities, detect any abnormal conditions, and anticipate the need for remedial actions. Observations of unusual flow or ponding would be reported to insure that solutions are analyzed, and contained or treated if necessary.

An inspection form would be used to document and guide the monitoring process. Items specifically monitored would include: 1) flow from the base of the waste rock disposal facility; 2) unusual ponding in the drainage collection ditch; 3) precipitates or staining on, or downstream of, the disposal facility; and 4) slope failure and exposure of potentially acid-generating waste.

Waste rock would be tested under procedures established by the State of Nevada in "Waste Rock and Overburden Evaluation," September 14, 1990. Waste rock samples would be combined into weight-averaged composites on a biannual basis and would be analyzed for leachability (Meteoric Water Mobility Procedure) and acid generation/acid neutralization potential. Evaluations of waste rock analyses would be included in permit-mandated Quarterly Water Reports for the facilities.

Gold Quarry North Waste Rock Disposal Facility

Newmont proposes to expand the Gold Quarry North WRDF to receive waste rock produced from the continued mining of the Gold Quarry Mine. The expanded Gold Quarry North WRDF would impact 57 acres of public domain lands and 382 acres of private land (**Table 2-6)**. This facility would also encroach on private lands previously disturbed by ancillary facilities and stockpiles and would completely cover the Gold Quarry Leach Pad. This facility is currently inactive and in the beginning stages of closure, which include rinsing and decommissioning according to the closure plan approved by NDEP. The closure plan would be fully implemented prior to placing any waste rock on the decommissioned leach pad. The pipeline in Chukar Gulch would be removed prior to covering with waste rock.

Gold Quarry South Waste Rock Disposal Facility.

Newmont proposes to expand the Gold Quarry South WRDF to receive waste rock produced from the continued mining of the Gold Quarry Mine. The expanded Gold Quarry South WRDF would encroach on private lands previously disturbed by ancillary facilities and stockpiles would disturb an additional 205 acres of public domain lands and 30 acres of private lands (**Table 2-6**).

James Creek Waste Rock Disposal Facility

Newmont proposes to expand the James Creek WRDF located on the southwest side of the Gold Quarry Mine. The expanded James Creek WRDF would encroach on private lands previously disturbed by the Maggie Creek WRDF, James Creek tailing facility, haul roads, and ancillary facilities and would disturb an additional 255 acres of private land (**Table 2-6**).

South Area Leach Facilities

The existing oxide leach facilities in the South Operations Area would be expanded to accommodate the low grade oxide and biooxidized sulfidic refractory ore from the proposed Gold Quarry Mine expansion. The South Area Leach facility expansion would consist of a southern extension of the existing Non-Property Leach Pad and construction of the Property Leach Pad 2. The leach pads would continue to be stacked in lifts to a maximum height of 300 feet. The expansions would be located in Section 18, T33N R52E and would be loaded using either conventional haulage trucks or a conveyor system. Process and stormwater ponds would be constructed down gradient of the proposed leach pads. The proposed leach pads would share the same process and stormwater ponds. All ponds would be fenced in compliance with Nevada Division of Wildlife (NDOW) specifications.

The Non-Property Leach Pad would be expanded along its existing southern edge and would disturb 182 acres of public lands (**Table 2-6**). The expansion would buttress against the existing Non-Property Leach Pad and would ultimately contain approximately 245 million tons. The Property Leach Pad 2 would be operated independently from the existing Property Leach Pad. The proposed Property Leach Pad 2 including process and stormwater ponds would disturb 163 acres of public lands and would contain approximately 46 million tons. The diversion ditch from Section 7 to Section 18 T33N, R52E, would be extended around the south side perimeter of the non-property Leach Pad expansion. The new process ponds would be made safe for wildlife according to NDOW regulations. Newmont's Plan of Operations would use the technique of maintaining the solutions at concentrations below levels considered lethal to wildlife. **Figure 2-3** shows the location of the proposed Non-Property Leach Pad expansion, Property Leach Pad 2, and the process and stormwater ponds. **Figure 2-3** also shows the perimeter fence that was modified in the Plan of Operations Amendment of 12/12/97 (Newmont, 1997d).

Refractory Leach Facility

Newmont proposes to construct an expansion to the Refractory Leach Facility to provide both a biooxidation leach pad and an ammonium thiosulfate leach pad for heap leaching the carbonaceous sulfidic refractory ore in lifts without removing it from the pad. New process ponds for the refractory leach facility would be made safe for wildlife according to NDOW regulations. Newmont's Plan of Operations would use the technique of maintaining the solutions at concentrations below levels considered lethal to wildlife. This proposed Refractory Leach Facility expansion would disturb an additional 108 acres of public land and 219 acres of private land (**Table 2-6**). Newmont has begun construction on the private land where they have approval to construct from the 1993 Record of Decision. The need for additional refractory leach area had not arisen until recently.

Ancillary Facilities

Expansion of the primary facilities would require very limited expansion of ancillary facilities, including access roads, lay down yards, water and solution pipelines, water quality monitoring wells, surface water diversion ditches, and power distribution systems. The perimeter fence would be expanded to include all new facility expansion (**Figure 2-3**).

Water Treatment Facility

If necessary to meet water quality standards, the existing permitted water treatment system could be reactivated from its inoperative status. The treatment facility has not been needed for several years. The water treatment facility utilized a chemical precipitation process to reduce metal concentrations in dewatering effluent to be discharged to Maggie Creek. Lined ponds have been constructed in which chemical precipitation and clarification of the water takes place. Sludge resulting from the chemical precipitation process would be periodically pumped from the bottom of each treatment pond and trucked to the tailing facility for disposal. Chemicals used in the water treatment facility included ferric sulfate, flocculants, and coagulants. Only minor amounts are currently stored on site.

The cooling tower installed east of Highway 766 would continue to be used when necessary to reduce the temperature of treated discharge waters such that water temperature of the Humboldt River at the confluence of Maggie Creek would be maintained within 2°C of ambient water temperature (State of Nevada water quality standard). Newmont's NPDES permit allows discharge into Maggie Creek with temperatures up to 77 degrees Fahrenheit.

Water Control Ditches

The SOAPA provides for construction of water control ditches for each new or modified facility. Existing diversion ditches would be maintained in accordance with NDEP requirements.

Pursuant to applicable regulations, surface water diversion ditches would be constructed around the final perimeter of the pits and WRDFs to prevent runoff from and run-on to these facilities. The diversion ditch above the South WRDF in Sections 10, 11, and 14, T33N, R52E, would be relocated to the west, as shown in **Figure 2-3**. Comparing **Figures 2-2 and 2-3** illustrates this relocation.

Best management practices for control of surface erosion and sedimentation from disturbed areas would be implemented at new disturbance sites (e.g., netting, straw bales, sediment control ponds). Flow of surface water would be directed around waste rock disposal areas, leach pads and the tailing impoundment. After closure and reclamation, all runoff would be directed back to natural drainage.

Resource Monitoring

Air Quality

Air resource monitoring would continue pursuant to current permits and regulations as discussed in Resource Monitoring under Existing Operations.

Water Resources

Hydrologic monitoring of surface water, groundwater, and springs/seeps in the study area would continue under the Proposed Action. The Maggie Creek Basin Monitoring Plan (Newmont, 1999c) and the monthly hydrographs would continue to provide a means of evaluating potential impacts during and after mining. Monitoring wells are used to measure water levels and/or water quality. As a result of the South Operations Area Project EIS, spring and seep monitoring would be changed and would continue with annual monitoring in the fall to evaluate changes in flow and water quality. Surface water monitoring would continue to be conducted on six streams and the Humboldt River. Monitoring of water resources would continue after cessation of mining activities in the South Operations Area. Spring flow mitigation would continue at impacted springs until the applicable trigger well returns to within 10 feet of its pre-impact level (based on existing monitoring data), or until the BLM determines that mitigation is no longer necessary, whichever is sooner (BLM, 1993). Because the Carlin "Cold" Springs are the primary source of water for the town of Carlin, Newmont has agreed to maintain an adequate supply of potable water should any deficiency occur due to dewatering activities. See Appendix A for a progress report on implementation of the SOAP Mitigation Plan.

As a result of the combined groundwater drawdown effects area between Newmont's South Operations Area and North Operations Area, and Barrick Goldstrike's Betze Mines, several streams north of the South Operations Area that are tributary to Maggie Creek could be affected by flow reductions (Chapter 5, Cumulative Effects). Therefore, a cooperative monitoring program would be established for these two mining companies to evaluate potential impacts to these streams.

Potentially Acid-Producing Rock

Monitoring of waste rock and sulfide ore stockpiles would continue according to existing permits and regulations, as discussed in Resource Monitoring under Existing Operations. New refractory ore stockpiles and waste rock dump facilities would be designed and constructed in a consistent manner throughout the South Operations Area Project. These practices are intended to minimize potential for acid drainage by control of the acid generation process. In general, these procedures are based on the strategy that acid generation can best be prevented by minimizing the amount of water which contacts potentially acid generating rock. Both refractory ore stockpiles and sulfide waste dumps are designed and constructed to limit the exposure of sulfidic material to atmospheric oxygen, groundwater, direct precipitation, snow melt and storm-water run-on.

The SOAPA plans on mining approximately 58 percent refractory ore and 42 percent oxide ore over the project life. While this would result in more potentially acid producing waste rock than neutral or acid-consuming waste rock, the proposed plans for encapsulation would still be applicable. The illustrations accompanying the Refractory Ore Stockpile and Waste Rock Dump Design, Construction and Monitoring Plan show two means of encapsulation, a hillside configuration and a basin configuration. Both configurations indicate encapsulation of large volumes of potentially acid-producing rock with smaller volumes of oxide waste and neutralized waste rock, respectively.

Access for snow removal is an integral part of dump and stockpile design and construction. When necessary, snow would be removed from the top surface of the stockpile and placed outside the diversion ditch boundary to limit the amount of snow melt infiltration and runoff collected in the ditches. The procedure for controlling acid generation includes:

Potentially Acid Generating Waste

1. Segregation and placement of sulfide wastes in internal areas of waste rock dumps above a prepared base.
2. Total enclosure or encapsulation of the sulfidic waste zone with non-acid producing material.
3. Careful sloping and random wheel compaction of individual lift surfaces.
4. Control of surface water flows to prevent infiltration.
5. Placement of a low permeability cap over the final encapsulation cell.
6. Reclamation of waste rock disposal facilities, including establishing vegetation, to minimize water infiltration.
7. Collect all drainage from facility and use it in processing. Processing would continue for more than five years after waste rock generation ceases.
8. After mining ceases, all potentially acid-generating material would be fully encapsulated and a low permeability cap placed over the disposal facility and no acid rock drainage is expected to occur.

Refractory Ore

1. Placement of refractory ores on a low permeability base.
2. Careful sloping and random wheel compaction of individual lift surfaces.
3. Control of surface water flows to prevent infiltration.
4. Collect all drainage from facility and use it in processing.

Wastes - Solid or Hazardous

Hazardous Substances

Newmont does not anticipate an increase in the present levels or types of hazardous substances transported, stored, used, treated, recycled, or disposed of on-site at the South Operations Area. Hazardous substance management is described in Hazardous Substances under Existing Operations in this chapter.

Tailing Composition

The Proposed Action is expected to generate tailing from two sources: (1) the existing Mill 5 and Mill 6. Mill 5 would continue to generate tailing composed primarily of finely ground rock; and (2) weak cyanide aqueous solution with a daily production of approximately 10,500 tons. The combined tailing would also receive a small volume of material generated by the refining facilities. The tailing would be similar in composition to the tailing generated by current operations (**Table 2-4**).

Mill 6 would continue to generate a tailing similar to that of Mill 5. Mill 6 operations are expected to generate approximately 10,000 tons per day of tailing material. Most solution would be reclaimed from the tailing and reused in the milling process.

Human Health and Safety

Human health and safety programs and requirements would be the same as those described in Human Health and Safety under Existing Operations in this chapter.

Closure and Reclamation

Newmont has committed to a comprehensive reclamation plan in order to achieve post-mining objectives of livestock grazing, wildlife habitat, and recreational use. This reclamation would entail establishing a self-sustaining, high quality, diverse ecosystem on most disturbed land. The reclamation plan includes: detoxification of heaps; drain down and evaporation of process water; regrading of haul roads, waste rock disposal areas; heap leach pads, tailing impoundments, tailing embankments, process ponds, and ancillary facility areas; erosion and sedimentation control measures; and topsoil replacement. Amendments and fertilization, seeding, and post-reclamation monitoring to ensure stabilization and revegetation is successful would also be completed.

Reclamation activities described in this section address both existing mine lands and lands included in the SOAPA. As various facilities, including the mine pit, waste rock disposal areas, leach heaps, and ancillary facilities, reach the end of their useful lives, Newmont would institute appropriate closure methods for these facilities. In compliance with the BLM and NDEP regulations 43 CFR 3809 and NAC519A, respectively, Newmont has filed a reclamation plan entitled Gold Quarry Operations Area Reclamation Plan, May 1996 and two amendments in 1997. The plan encompasses disturbances associated with the existing South Operations Area activities. The reclamation schedule proposes final revegetation activities ending in 2017.

Reclamation activities include closure of tailing and heap leach facilities, installation of pit fencing or berms, removal of structures not needed after cessation of operations, regrading of disturbed areas (including waste rock piles and roads), drainage control, replacement of salvaged soils, revegetation, closure of water and monitoring wells not needed after cessation of operations, and reclamation monitoring.

Soil Salvage

Newmont has salvaged topsoil from previously authorized disturbance areas and would continue to salvage topsoil in areas to be disturbed by the SOAPA. Most previously salvaged topsoil has been stockpiled for use in later reclamation although some topsoil has been used in ongoing reclamation at the mine. Topsoil stockpiles would be located throughout the South Operations Area in proximity to sites that eventually would be reclaimed. Major proposed topsoil stockpiles are shown in **Figure 2-3**. Topsoil stockpiles are protected from wind and water erosion through establishment of vegetative cover.

Newmont proposes stripping an average of 12 inches of topsoil from newly disturbed mine areas, resulting in a volume of approximately 2.2 million cubic yards. For Newmont to cover all proposed disturbances with approximately 6 inches of topsoil would require 1.1 million cubic yards. The excess soil resource would be available for use on other existing disturbance areas.

Newmont has identified four stockpile locations for the Proposed Action. These topsoil stockpiles would cover approximately 116 acres of public land and 82 acres of private land adjacent to the respective disturbance areas. These acreage figures have been included within the Incremental Disturbance Acreage figures outlined in **Table 2-6**. The four topsoil stockpiles would have the capacity to store more than the 2.2 million cubic yards proposed for salvage (up to 2.6 million cubic yards of material at an average height of 8 feet).

Revegetation

A test-plot program has been implemented to evaluate and select successful, site-specific reclamation measures. These measures included different aspects and soil types. Various surface preparation practices were also evaluated for their success in promoting plant establishment and resistance to soil erosion. Areas undergoing concurrent reclamation within Newmont's mining operations are being utilized as the test plots. The reclamation studies were developed in cooperation with BLM, NDEP, and NDOW. Based on the results, plant mixtures and cultivation practices were selected for reclaiming disturbed areas.

Disturbed areas would be ripped and scarified to a minimum depth of six inches and a maximum depth of three feet, with ripper blades approximately 52 inches apart. The surface would be ripped a total of three times, parallel, perpendicular, and diagonally. This method averages a depth of 12 and 18 inches over the surface to promote revegetation. The open pit would remain open, but would be restricted from public access with fences and/or berms to ensure public safety.

Organic amendments may be used to enhance reclamation success. Organic amendments such as fertilizers or mulch may include straw, manure, sludge, or decomposed plant material.

On steeper slopes, mulch would be held in place by chemical tackifiers. If mechanical equipment is employed, mulch would be applied and crimped after seeding.

Newmont would develop a seedbed using the most appropriate techniques determined during concurrent reclamation. The surface would then be broadcast, drill, or aerial seeded depending on the slope of the surface. As part of the test-plot program, seed mixtures would be developed so that a mosaic pattern of three to four seed mixtures could be seeded on mine disturbances. **Table 2-9** presents the master seed list from which seed mixtures would be developed. Application rate would be from 6 to 15 pounds of pure live seeds per acre. Non-native species would be used only when needed for soil stabilization early in revegetation operations.

Noxious Weed Control

Newmont conducts annual weed surveys and uses that information to help implement their ongoing weed control program. Survey results would indicate where weed populations are expanding or where new populations are getting established. Resources to control weeds are then allocated according to the priorities of the control program. Newmont uses several methods to control weeds, including spraying, mowing, and covering (occasionally earth moving activities literally cover infested sites).

Mine Pit

Reclamation activities for the Gold Quarry pit would include constructing diversion channels to minimize surface water runoff into the pit, constructing berms around the pit to prohibit

TABLE 2-9
SEED LIST

Thickspike wheatgrass *Agropyron dasystachyum*	Pubescent wheatgrass *Agropyron trichophorum*
Streambank wheatgrass *Agropyron riparium*	Bluebunch wheatgrass *Agropyron spicatum*
Sandberg bluegrass *Poa sandbergii*	Indian ricegrass *Oryzopsis hymenoides*
Webber ricegrass *Oryzopsis webberi*	Idaho fescue *Festuca idahoensis*
Green needlegrass *Stipa viridula*	Bottlebrush squirreltail *Sytantion hystrix*
Great Basin wildrye *Elymus cinereus*	Crested wheatgrass *Agropyron cristatum*
Sheep fescue *Festuca Ovina*	Western wheatgrass *Agropyron smithii*
Slender wheatgrass *Agropyron trachycaulum*	Canby bluegrass *Poa canbyi*
Sand dropseed *Sporabolus cryptandrus*	Alkali sacaton *Sporabolus airoides*
Yellow sweetclover *Melilotus officinalis*	Cicer Milkvetch *Astragalus cicer*
Northern sweetvetch *Hedysarum boreale*	Buckwheat *Eriogonum* sp.
Common sainfoin *Onobrychis viciaefolia*	White sweetclover *Melilotus alba*
Alfalfa *Medicago sativa*	Annual ryegrass *Lolium perenne multiflorum*
Barley *Hordeum* sp.	Western yarrow *Achillea millefolium*
Small burnet *Sanguisorba minor*	Blue flax *Linum lewisii*
Gooseberryleaf (Scarlet) Globemallow *Sphaeralcea grossulariaefolia*	Scarlet globemallow *Sphaeralcea coccinea*
Palmer penstemon *Penstemon palmeri*	Big Sagebrush *Artemisia tridentata var. tridentata, wyomingensis*
Chokecherry *Prunus virginiana*	Black sage *Artemisia nova*
Shadscale *Atriplex confertifolia*	Fourwing saltbush *Atriplex canescens*
Prostrate summer cypress *Kochia prostrata*	Serviceberry *Amelanchier (alnifolia) (utahnsis)*
Winterfat Ceratoides lanata	Rubber rabbitbrush *Chrysothamnus nauseosus*
Mormon tea *Ephedra (nevadensis) (viridis)*	Antelope bitterbrush *Purshia tridentata*
Snowbrush *Ceanothus spp.*	Currant *Ribes spp.*
Woodsrose *Rosa woodsii*	Snowberry *Symphoricarpos spp.*

Source: Newmont, 1996.

access, and posting warning signs to identify potential safety hazards. In the event the pit is fenced, it would be with either a 4- or 5-strand barbed wire fence. All direct access for the pit would be eliminated. The formation of a lake in the pit is described in Chapter 4. The project area perimeter fence would be maintained through the completion of successful reclamation.

Waste Rock Disposal Areas

Waste rock would be placed by end-dumping an advancing face in successive horizontal lifts averaging 100 feet in height, which would vary in height depending on topography. Based on geotechnical and erosional stability criteria, the final reclamation configurations for the waste rock disposal areas would include regrading of slopes to achieve an overall slope of approximately 2.5H:1V. Overall slope is defined as the total change in elevation from beginning top crest to final bottom toe, divided by the corresponding horizontal distance between. The top surface and bench surfaces are designed to promote runoff.

The waste rock disposal facilities are designed and constructed using a conservative calculated factor of safety, which minimizes the potential for failure. Grading would minimize the potential for mass failures or rill erosion, facilitate reclamation activities, and promote better vegetation establishment. Sharp edges would be rounded off by regrading, resulting in the development of undulating slopes.

Potentially acid generating waste rock would be excavated during mining operations. This material would be encapsulated with non-acid-generating material to prevent the potential to generate acid or mobilize contaminants pursuant to Newmont's "Refractory Stockpile and Waste Rock Dump Design and Construction Guideline" and "Refractory Stockpile and Waste Rock Monitor Plan." Newmont stores or would store potentially acid generating waste in the Gold Quarry South WRDF, Gold Quarry North WRDF and the Refractory Leach foundation. Revegetation would then be carried out as previously described. Potential upgradient run-on to each waste rock disposal area is or would be diverted by designed drainage ditches. Each channel is or would be designed to contain discharge from the 100-year 24-hour storm event and direct the flow into natural drainages downgradient from each disposal area.

Tailing Storage Facility

The existing James Creek tailing facility would be disturbed to allow expansion of the Gold Quarry pit, and the modified tailing facility would require reclamation. The James Creek facility would be reduced in volume by hauling tailing to the Mill 5/6 tailing facility. After removing tailing from the northwest margin of the tailing facility, a new embankment would be constructed to retain the remaining tailing in the James Creek facility, and existing, approved drainage controls would be reestablished. Then reclamation of the new embankment and the surface of the modified James Creek tailing facility would be conducted. The new surface would be graded, topsoil would be spread, seed would be applied, and fertilizer and mulch would be applied to complete the revegetation process.

The reclamation plan for the Mill 5/6 tailing impoundment includes the following. Once the surface is capable of supporting equipment, it would be graded to reduce irregularities with a final slope of less than 1 percent toward the southwest, where a closed basin would then be formed within the tailing embankment. Existing berms upslope of the disposal facility would limit water run-on to the surface of the tailing facility so that only precipitation would enter the closed basin. The basin would be designed to contain the design storm event and evaporation would remove the water. Sideslopes for the storage facility would be fertilized and covered with 6 inches of previously salvaged topsoil. Topsoil available for spreading is limited to the amount salvaged prior to operations. Newmont's Reclamation Plan (as amended) states that topsoil will be spread at depths from 0 to 12 inches, depending on site-specific conditions. The tailing storage facility would be broadcast seeded, fertilized, and mulched using straw and other materials. It is expected that continuous seepage of residual tailing solution would cease several years after tailing deposition is halted and final closure and remaining reclamation could then be completed.

Natural degradation processes would be expected to reduce the cyanide concentration in the seepage to below the present regulatory criterion of 0.2 milligrams per liter (mg/L) weak acid dissociable cyanide and stabilize the pH at between 6 and 9 standard units. High-density polyethylene pond liners beneath seepage collection ponds would be folded and buried at least 5 feet below the backfilled surface. Backfilled areas would then be revegetated. Newmont (1996) presents additional information on reclamation of the tailings storage facility.

Leach Pads

The following heap leach facilities are associated with this amendment:

- Non-Property Leach Pad expansion;
- Property Leach Pad 2; and
- Refractory Leach Facility expansion.

The Non-Property pad expansion and the Property Leach Pad 2 pad utilize the cyanide method of gold extraction. The Refractory Leach Facility expansion utilizes an ammonium thiosulfate extraction process that would not require neutralization/detoxification. This material type is currently treated as potentially acid generating waste in the bioleach demonstration facility. This material type is currently, and would continue to be, encapsulated with non-acid-generating material to prevent the potential to generate acid or mobilize contaminants pursuant to Newmont's "Refractory Stockpile and Waste Rock Dump Design and Construction Guideline" and "Refractory Stockpile and Waste Rock Monitoring Plan." The Refractory Leach Facility has been designed for removal of spent ore, whereas the expansion facility for oxide material would remain in place for encapsulation.

Spent ore on the oxide heap leach pads utilizing the cyanide process would undergo detoxification and neutralization procedures prior to reclamation. Detoxification and neutralization are required to reduce the weak acid dissociable (WAD) cyanide concentration level to less than 0.2 mg/L and to reduce the pH to between 6 and 9, as required by NAC 445A.430.

The rinsing phase would be conducted concurrently with the final gold producing leach activities. It is anticipated that gold can be produced for approximately three years after ore loading ceases. Detoxification would commence during this time period. The heap leach pads would be allowed to drain freely to reduce the volume of solution in circulation during rinsing. The drained solution would be recirculated or discharged to the tailings impoundment until low pH and increased water quality levels are reached. Rinsate would be recirculated through the ore until the criteria of less than 0.2 mg/L WAD cyanide level and pH of 6 to 9 are achieved.

If reasonable attempts to reduce WAD cyanide levels or other constituent levels in the spent oxide heaps are not successful, Newmont would submit proposals to the NDEP for alternatives to meet levels acceptable to the NDEP.

All rinsate, residual liquor, and rain and/or snowmelt would be collected from the spent heaps following completion of detoxification and neutralization procedures for appropriate disposal through the use of passive treatment or evaporation. At the completion of all detoxification/neutralization and evaporation procedures, the collection system would be removed and reclaimed according to the following sections.

The Refractory Leach Facility expansion would be encapsulated and reclaimed following final gold extraction. The cyanide process pads would be reclaimed following detoxification and neutralization. Side slopes would be regraded to achieve an overall slope of 2.5H:1V. This overall slope would be achieved by regrading inner ramp slopes to 2.3H:1V with 10-foot benches remaining for approximately every 50 feet of elevation change. Where lift heights and bench widths vary, regrading would be performed to provide a maximum overall slope of 2.5H:1V. The top surface and bench surfaces would be graded to promote runoff. Growth media is limited within this operation area; therefore, alternative amendments may be used as mentioned in the revegetation section.

Potential run-on to the heap leach pads would be collected and conveyed off and away from the area via drainage ditches. Heap leach pads would have associated trapezoidal-sectioned drainage ditches designed to collect and convey the 100-year 24-hour storm event.

The following process and stormwater ponds are associated with this amendment:

- Property Leach Pad 2 pregnant solutions and storm events ponds; and
- Refractory Leach expansion ore pregnant solution and storm events ponds.

Solutions present in the pregnant solution ponds would be stabilized and neutralized concurrently during detoxification and neutralization of the heap leach material. The ponds would remain operational until all detoxification and neutralization procedures are completed.

Reclamation of each of the lined ponds would be similar in method. Impounded water or solution present at the end of operations would be disposed of either by evaporation, as would be the case for solutions present in the pregnant solution ponds, or by pumping to the Mill 5/6 tailings impoundment. Any accumulation of precipitates on the bottom of these lined ponds would be removed and analyzed for proper disposition. Any hazardous waste found would be disposed of at an appropriate disposal facility and would follow state and federal regulations for handling and disposal. Non-hazardous waste would be placed in the tailings facility. High density polyethylene HDPE liners would be cut up or punctured, folded and covered in place to a minimum depth of 5 feet below the reclamation surface. No sludge or precipitate from pond bottoms would be placed in Newmont's Class III landfill. Pond areas would then be backfilled and the surface graded to establish a reclamation surface configuration that is compatible with surrounding terrain, and to the extent possible, reestablishes the pre-mining surface of the area. Following grading, the reclamation surface of the pond areas would be prepared and revegetated as described in an earlier section.

The surfaces developed during reclamation would establish drainages and flow paths to facilitate runoff into existing natural drainages located downgradient. All existing natural drainage areas would be utilized, and as necessary, minor reconstruction of these drainages may be performed to control runoff.

Haul Roads

Access road and haul roads exist in the project area. Reclamation activities include the following:

- distributing safety berm material that may contain topsoil on the top of the former roadway;
- grading to approximate pre-disturbance topography;
- ripping/scarifying; and
- revegetating.

The majority of roads are associated with the waste rock disposal areas and heap leach pads and would be reclaimed concurrently with the closure of each individual area. Remaining roads would be reclaimed when they are no longer needed for site access. Remaining portions of haul roads not on the waste rock disposal areas or heap leach pads would be reclaimed by regrading, as necessary to promote drainage and revegetated with techniques described in a preceding section. Regrading would, to the extent practical, reestablish pre-disturbance topography and drainage and provide slopes that would, in conjunction with revegetation, control erosion. One culvert would be constructed in association with this amendment. This culvert would be located at the crossing of the James Creek diversion ditch and the James Creek WRDF haul road, and would be removed upon reclamation. Waterbars would not be installed as part of road reclamation. The reclamation surfaces are designed, in conjunction with revegetation, to minimize surface runoff from the reclamation surfaces and reduce erosion.

The reclamation plan would facilitate natural drainage in the area by directing flow where necessary via drainage ditches, establishing erosion protection where concentrated flow may potentially occur, and restoring and stabilizing surface water drainage. Material will be excavated or regraded as necessary in the drainage areas to facilitate natural drainage and restore free flow. Outlets of drainage ditches would be widened and protected with rock to dissipate energy prior to re-entry into the natural drainage areas.

Ancillary Facilities

Ancillary buildings, and other structures would be dismantled and removed following cessation of operations. Nonsalvageable material (e.g., pond liner, scrap building material, concrete) would be buried on-site or disposed of off-site in compliance with NDEP regulations. Concrete foundations, basements, walls, and sumps would be cracked or broken and buried. Materials that had been in contact with cyanide or other toxic chemicals would be decontaminated prior to disposal. If any materials cannot be rendered non-hazardous, they would be disposed of in appropriate hazardous material disposal facilities.

Disturbed areas would be graded to blend with adjacent topography. Graded surfaces would be spread with 6 inches of topsoil, and ripped to a depth of 12 to 18 inches, where necessary. Seeding, harrowing, and mulching would occur as previously discussed.

Other ancillary facilities including structures, powerlines, and surface pipelines would be removed and lands associated with these facilities would be regraded to contour. Buried pipelines would be plugged and left in place. Some run-on and runoff control ditches would remain as part of the reclamation program to control sediment loss from the site.

Monitoring/Evaluation of Reclamation Success

Qualitative erosion monitoring would be conducted annually to assess effectiveness of erosion control structures, overall stability, and effectiveness of drainage channels. Appropriate measures would be implemented to correct any erosion problems.

Revegetation monitoring would be conducted annually for at least 3 years to assess vegetative cover. Revegetation success would be evaluated based on comparison between the identified and designated “reclaimed desired plant community” and the “reference area.” Reference areas would be selected from representative plant communities adjacent to the mine site, test plots, or demonstration areas or, as appropriate, representative ecological range site descriptions. The identified and designated “reclaimed desired plant community” and “reference area” would be selected in consultation with the BLM and NDEP.

Revegetation release criteria for reclaimed mine sites would be to achieve as close to 100 percent of the perennial plant cover of selected comparison areas as possible. Reclaimed areas not meeting these standards would be evaluated and corrective actions implemented. Revegetation success would be determined by comparison with the criteria described in the Nevada Guidelines for Successful Revegetation for the NDEP and BLM.

PROJECT ALTERNATIVES

This section describes alternatives to the Proposed Action including the No Action Alternative, features common to all alternatives, alternatives eliminated from detailed analysis, and the Agency Preferred Alternative. Alternatives selected by BLM for consideration in this EIS are based on potential impacts associated with the Proposed Action and issues, including those identified by the public during the scoping process. The BLM is required to analyze environmental effects resulting from the Proposed Action and to identify reasonable alternatives that would mitigate or eliminate potential impacts. The BLM is also required to analyze the No Action Alternative, which describes the environmental consequences that would result if the proposed project is not implemented.

Newmont’s SOAPA involves continuation of existing operations, construction and operation of various new facilities, and expansion of some existing facilities. Components of the planned operations, their respective functions, and potential environmental effects are also considered in delineation of alternatives.

Alternatives Considered in Detail

Features Common to All Action Alternatives

The following components of Newmont's SOAPA are common to all action alternatives considered in detail:

- Continued mining and expansion of the Gold Quarry Mine pit.
- Expansion of the Gold Quarry North, Gold Quarry South, and James Creek WRDFs.
- Expansion of the South Area Leach Facility.
- Expansion of the Refractory Leach Facility.
- Construction of Ancillary Facilities.
- Reclamation of facilities according to BLM and NDEP requirements.

Table 2-10 presents differences among alternatives for specific facilities. **Figure 2-4** illustrates the main differences in the two action alternatives.

Proposed Action with Backfilling of the Mac Pit

This alternative is essentially the same as the Proposed Action but would place some of the waste rock intended for the WRDFs into the Mac pit. With this alternative, some of the trucks hauling waste rock would exit the Gold Quarry Mine on the west side and would go north along the existing haul road and climb an additional 150 vertical feet (approximately) to reach the elevation of the edge of the Mac pit. It is anticipated that waste rock would be end-dumped from various locations along the south and west sides of the Mac pit. Hauling to the Mac pit would involve a trip with greater vertical distance but less horizontal distance than haulage to the Gold Quarry North and South WRDFs.

Calculations were made of the additional truck costs of backfilling the Mac pit in comparison to hauling the same waste rock to the North Waste Rock Disposal Facility. The haul profile for backfilling was 40,000 feet in length compared to 13,600 feet to the North WRDF, and 85 percent of the trip was climbing or descending a 10 percent grade compared to 29.4 percent of the trip to the North WRDF. This haul profile resulted in hauling 10.2 million tons of waste rock an additional 7.6 miles to the Mac pit instead of the North WRDF which translates to 22,199 extra hours of truck operation. The additional cost of the truck hauling alone was calculated at approximately $2.5 million. When considering the total cost involving driver salaries, plant administration, utilities, and other costs of doing business, the total cost would be approximately $6.5 million.

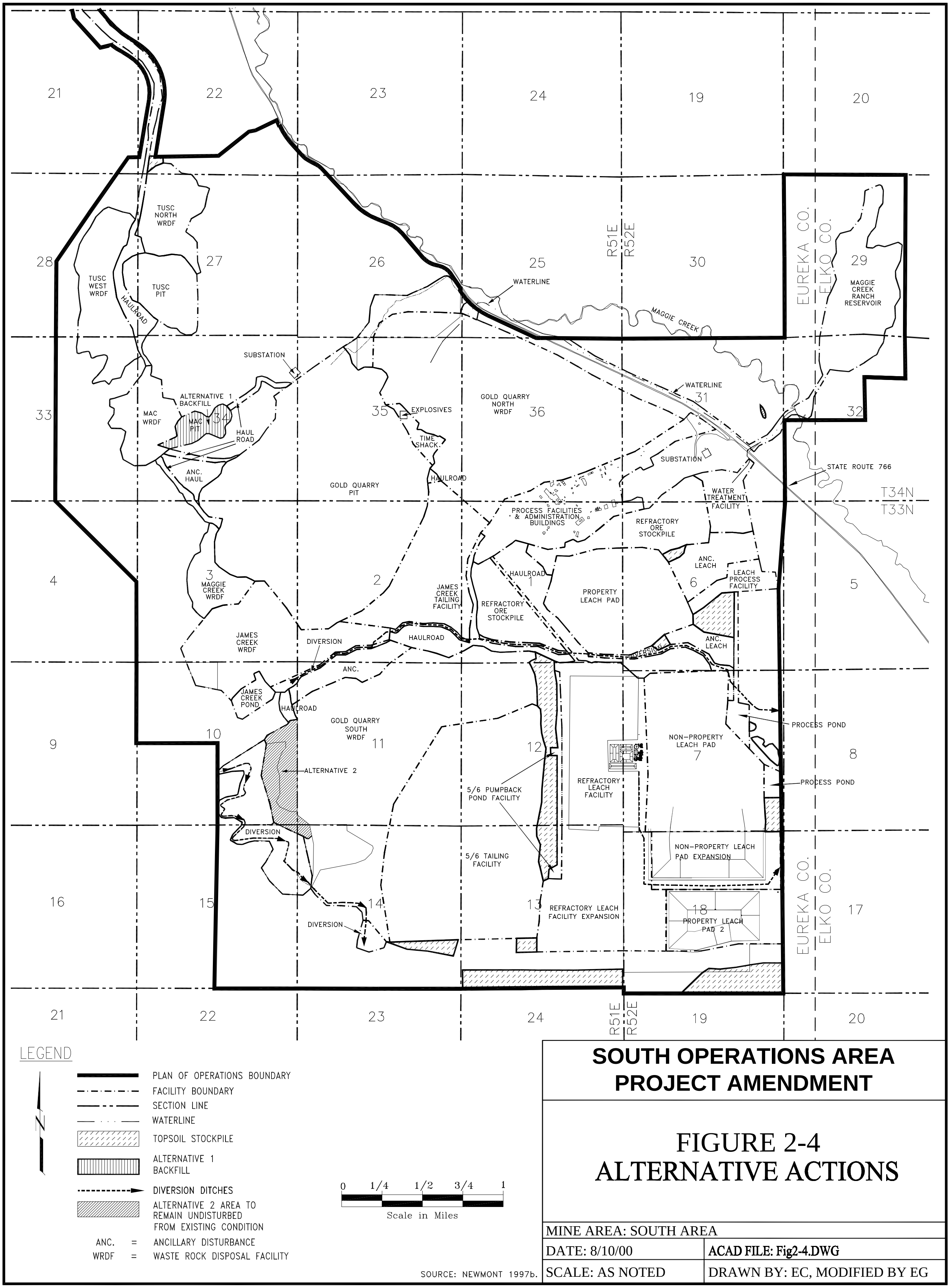
Backfilling the waste rock also could serve to reduce the northward and southward expansion and ultimate size of the Gold Quarry North and South WRDFs, respectively. However, the Mac pit would only contain approximately 2 percent of the proposed volume of waste rock to be generated by SOAPA, and the potential reduction in size of the other WRDFs would likely not be noticeable. If the potential reduction in size was in a reduced overall "footprint," it would be approximately 6 acres.

If the potential reduction in size resulted in a lower height of a WRDF, it would be approximately 4 to 8 feet. Any reduction in

TABLE 2-10
INCREMENTAL SURFACE DISTURBANCE BY ALTERNATIVE

Facility	Proposed Action	Alternative 1 Backfill pit	Alternative 2 Modified WRDFs
Gold Quarry Mine	139	139	139
Tusc Mine	0	0	0
Mac Mine	0	-40	0
Haulage Roads	59	59	59
Dewatering Facilities	-40	-40	-40
Waste Rock Disposal Facilities			
Gold Quarry North WRDF	439	436	439
Gold Quarry South WRDF	235	232	185
Maggie Creek WRDF	-82	-82	-82
James Creek WRDF	255	255	255
Tusc West WRDF	0	0	0
Tusc North WRDF	0	0	0
Mac WRDF	0	0	0
Processing Facilities	0	0	0
Ore Stockpiles	-38	-38	-38
Leaching Facilities			
Gold Quarry Leach Pad	-185	-185	-185
Property Leach Pad	0	0	0
Property Leach Pad 2	163	163	163
Non-Property Leach Pad	182	182	182
Refractory Leach Pad	327	327	327
Tailing Facilities			
James Creek tailing facility	-186	-186	-186
Mill 5/6 tailing facility	0	0	0
Diversion Channels	138	138	135
Topsoil Stockpiles	198	198	198
Ancillary Facilities	-190	-190	-190
Geologic Evaluations	-22	-22	-22
Total Incremental Disturbance of Undisturbed Areas	2,135	2,129	2,082
Total Net Disturbance Acreage	1,392	1,346	1,339

Note: Negative values are derived from existing disturbance that is incorporated into the proposed disturbance, with the exception of the Mac pit in Alternative 1.



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 2-4
ALTERNATIVE ACTIONS

MINE AREA: SOUTH AREA	
DATE: 8/10/00	ACAD FILE: Fig2-4.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

the size of the "footprint" of a WRDF would reduce impacts to existing soils and vegetation. **The Mac pit is not deep enough to penetrate the water table, so no effects on groundwater quality would be expected.**

A beneficial effect would result from backfilling the pit by providing an additional 40 acres of grazing land and wildlife habitat following reclamation and revegetation.

Another possible benefit of backfilling the Mac pit would be the reduced risk of accidental falls by humans and wildlife.

Proposed Action with Modified Waste Rock Disposal Facilities

This alternative is essentially the same as the Proposed Action, but with a different approach for handling waste rock disposal. This alternative was identified to address the issue of the location of waste rock to be placed in WRDFs and their ultimate aesthetic appearance.

The Proposed Action would include hauling waste rock to various locations including road and embankment construction sites within the project area, as well as three designated WRDFs including the Gold Quarry North, James Creek, and Gold Quarry South.

The proposed expansion of the Gold Quarry South WRDF would involve approximately 235 acres to the south and west of the existing Gold Quarry South WRDF. The expansion involves additional haul distances of up to 4,500 feet.

This alternative would substitute some of the horizontal distance to the west (into Section 10) for additional elevation of the Gold Quarry South WRDF in an attempt to have a smaller "footprint" for the Gold Quarry South WRDF and avoid constructing a new diversion channel west of the WRDF. Another lift on the Gold Quarry South WRDF would be about 50 feet in height.

Analysis considered eliminating approximately 50 acres in Section 10 along the western margin of the proposed expansion of the Gold Quarry South WRDF. Using a general volume/capacity figure of 500,000 tons of waste rock per acre of surface area in the proposed WRDFs, the elimination of 50 acres of the Gold Quarry South WRDF would require relocation of approximately 25 million tons into higher lifts on the existing and expanded Gold Quarry South WRDF. Twenty-five million tons might require two additional lifts or about 100 feet of elevation over much of the Gold Quarry South WRDF.

However, a reduced "footprint" for the proposed Gold Quarry South WRDF would not totally eliminate the requirement for a new diversion channel. Construction of a new diversion in the Proposed Action would involve clearing and shaping a drainage channel approximately 8,000 feet in length to intercept three unnamed drainages in the southeast quarter of Section 10 and the northeast quarter of Section 15. The diversion would then intersect with the existing diversion channel at a point just east of the section line between sections 15 and 14. The channel would be flat-bottomed with sloping sides and approximately 25 feet wide at its widest point. This diversion would require a 50-foot wide construction corridor and would disturb an area of approximately 9.2 acres.

Eliminating the portion of the Gold Quarry South WRDF in Section 10 would allow the continued use of the existing diversion in that location (an area of about three acres of disturbance). However, the main portion of the Gold Quarry South WRDF would abut higher elevation topography and would prevent connection with, and use of, any of the lower portion of the existing diversion without extraordinary construction measures (underground conduits or aboveground siphons).

No Action Alternative

Currently, Newmont has authorization from BLM to operate mining facilities on federal lands in the South Operations Area as provided in the South Operations Area Record of Decision (BLM, 1993) and subsequent approvals. Under the No Action Alternative, BLM would not authorize the SOAPA and additional disturbance of federal land would not occur. Newmont would still be liable for mitigation and monitoring commitments made in the original EIS Mitigation Plan (BLM, 1993).

AGENCY PREFERRED ALTERNATIVE

The Agency Preferred Alternative is the Proposed Action. This alternative is described previously in this chapter.

In the DEIS the preferred alternative was the Proposed Action with backfilling of the Mac pit. However, based on public comment and additional analysis of alternatives, the Proposed Action was selected.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

This section describes alternatives identified through the scoping process that were considered by BLM but dismissed from detailed analysis for various reasons described below. Generally, these alternatives were not technically feasible, economically reasonable, or would not meet the purpose and need of the Proposed Action. These alternatives were first evaluated and eliminated from detailed analysis in the previous EIS (BLM, 1993).

Underground Mining

This alternative would address the issue of surface disturbance impacts, including the areas proposed for the open pit and a portion of the waste rock. Underground mining has higher initial capital and operating costs than open pit mining and typically only becomes practical when extracting deep, high-grade ore. The Gold Quarry Mine expansion primarily is based on low-grade refractory ore, much of which is shallow, therefore, this alternative was eliminated from further consideration because it would be economically prohibitive to extract a large portion of the low-grade mineral reserves.

Water Disposal Alternatives

Four alternatives were evaluated to determine if all the excess water from the dewatering operations could be utilized in a more environmentally effective manner. Of the four disposal alternatives, none could fully demonstrate greater environmental effectiveness than the Proposed Action. Water disposal alternatives were reviewed for their possible effects on four issues: (1) retaining as much water as possible in the Maggie Creek Basin, (2) reducing the degree of impact on riparian habitat, (3) reducing the potential for groundwater loss to communities near the project area, and (4) reducing the area of impact of the groundwater cone of depression. None of the disposal alternatives fully addressed all four criteria, but four alternatives addressed one or more of the criteria and these are summarized below. Details are provided in BLM (1993).

- Reinjection of all excess water into bedrock in Maggie Creek Basin.

  Recycling of injected water into the mine, injection well inefficiencies, potential pit wall instability, and localized groundwater mounding resulting in surface seeps, rendered this alternative technically infeasible, and it was, therefore, eliminated from detailed analysis.

- Infiltration of all excess water into the shallow alluvial system in Maggie Creek Basin.

  This alternative was eliminated from detailed analysis because the Maggie Creek basin has inadequate capacity for disposal of a significant amount of excess water.

- Use of excess waters to irrigate lands in Maggie Creek Basin.

  Newmont currently irrigates in the lower Maggie Creek Basin and has evaluated potential irrigable lands in the upper Maggie Creek Basin. Total potential irrigation in the Maggie Creek Basin available to Newmont was significantly less than the volumes produced each year, thus eliminating this alternative from detailed analysis.

- Construction of East Cottonwood Creek Reservoir.

  This alternative was eliminated from detailed analysis because of its inability (even in combination with Maggie Creek Ranch Reservoir) to contain a significant portion of the excess water generated by the Gold Quarry project.

Backfilling the Tusc Pit

Backfilling the Tusc pit with Gold Quarry waste rock would require the longest haul of all possible locations in the South Operations Area and would also be the haul route with the greatest vertical climb. This would result in the most vehicle and fuel usage of all alternatives, and thus eliminated the alternative from detailed analysis.

Backfilling the Gold Quarry Pit

Backfilling the Gold Quarry pit would require rehandling of waste rock previously placed in waste rock disposal facilities because it is the last pit scheduled for completion. This would result in a significant increase in project duration and, therefore, fuel usage. The time extension and fuel costs eliminated this alternative from detailed analysis.

CHAPTER 3
AFFECTED ENVIRONMENT FOR PROPOSED ACTION AND ALTERNATIVES

CHAPTER 3

AFFECTED ENVIRONMENT FOR PROPOSED ACTION AND ALTERNATIVES

Studies have been conducted to characterize environmental resources in the proposed SOAPA area. The studies were designed to compare conditions in 1999 with those reported in 1993 in the previous EIS (BLM, 1993).

This chapter summarizes environmental baseline information for both the Proposed Action and other alternatives. For several environmental disciplines, this chapter refers the reader to the original EIS (BLM, 1993) for further baseline description of the resources. Within the following discussion, several area terms are used and their definitions are:

- Amendment area - the parcels of land comprising 1,392 acres which are proposed to be added to the South Operations Area, and in which expansion of facilities is proposed.
- Mine area or Disturbance area - areas within the project area where actual facilities are located or proposed.
- Project area - The area comprising Newmont's South Operations Area, encompassed by the perimeter fence.
- Study area - each environmental discipline defined its own study area. For example: soils were surveyed on the amendment area; socioeconomics were evaluated for Elko and Eureka counties; cultural resources were surveyed in a 9,352-acre disturbance area in several studies during the life of the project.

CRITICAL ELEMENTS OF THE HUMAN ENVIRONMENT

Of the 14 critical elements of the human environment which must be considered in environmental documents, all but four will be discussed in this document: (1) no areas of critical environmental concern are near enough to the SOAPA area that they would be affected; (2) no prime or unique farmlands are present in the study area; (3) no wild and scenic rivers are present in the study area; and (4) no wilderness areas are close enough to be affected. The Ruby Mountain and Jarbidge Wilderness areas are 40 and 55 miles distant, respectively. Of the ten wilderness study areas on lands near SOAPA, the nearest, Red Spring and Cedar Ridge, are 25 miles to the southeast.

GEOLOGY AND MINERALS

Geologic Setting

The project area is located within the Basin and Range physiographic province, a semi-arid region stretching from southeastern Oregon to Arizona. In Nevada, this province is characterized by roughly parallel fault-block mountain ranges which generally trend north-south. The ranges are separated by nearly level desert basins filled with alluvium derived from the adjoining mountains. The project area itself is located within the Maggie Creek valley and on the lower eastern slopes of the north-south trending Tuscarora Mountains.

The study area comprises the Carlin Trend, a 50-mile long feature characterized by gold deposits in sedimentary rock extending southeast-northwest through the Tuscarora Mountains. It stretches from the Rain Mine (approximately 10 miles southeast of the town of Carlin) to the Hollister Mine, approximately 40 miles to the northwest. Within the project area, the gold deposits are found in a window of Paleozoic rock, including the Roberts Mountains Formation. This window is surrounded by younger Cenozoic-era sedimentary bedrock of the Carlin Formation (Roberts, Montgomery, and Lehner, 1967). Throughout most of the project area, bedrock is mantled by unconsolidated Quaternary alluvial, colluvial, conglomerate, and landslide deposits (Knight Piesold, 1990). The geology of the area is described and illustrated in BLM (1993).

A generalized characterization of waste rock to be removed from the Gold Quarry pit is derived from the characterization of the ultimate pit surface presented in Geomega (1997b). The pit surface was simulated to consist of six units characterized by their net carbonate value, a measure of acid generation or acid neutralization potential, if negative or positive, respectively. The six units are: (1) alluvium in the Tertiary Carlin Formation, a weakly cemented, fine-grained material. The net carbonate values of this unit are generally slightly positive (+0.47) because the alluvium contains very little sulfide or carbonate; (2) carbonaceous silicious refractory rock in the Rodeo Creek siltstone. The net carbonate values of this unit are generally negative to zero because this rock contains both sulfide and carbonate minerals and ranges from -2.19 to +0.66; (3) sulfidic, silicious refractory rock in the Rodeo Creek siltstone characterized by dark siltstone with visible pyrite grains. The net carbonate values of this unit are predominantly negative because of the greater than 2 percent sulfide content, ranging from -2.74 to +6.60; (4) oxidized silicious rock contained in the Rodeo Creek siltstone is a tan siltstone, with net carbonate values ranging from -1.29 to +0.66 because of low sulfide and carbonate contents; (5) oxidized calcareous rock in the Popovich limestone is a light-colored limestone with net carbonate values greater than +7; and (6) unoxidized calcareous rock in the Popovich limestone is a dark-colored limestone with net carbonate values greater than +15.

Geologic Hazards

The potential for development of sinkholes or similar collapse features that could result from mine induced drawdown and water management activities has been identified as a significant issue for the assessment of cumulative impacts to geology and minerals within the project area (BLM, 2000b). These features form with the dissolution of calcium carbonate in limestone and dolomite. Lowering the water table can increase vertical seepage rates and cause collapse of near surface caverns which are buoyed by the water table. The solution process may be accelerated somewhat by these artificial changes in groundwater conditions such as higher velocity water movement through geologic materials susceptible to dissolution.

Draining of water from caverns and other void spaces may also cause collapse of unconsolidated sediments overlying them.

The Roberts Mountains Formation comprising the gold-bearing window within the project area is comprised primarily of limestone and dolomitic limestone (Rota, 1991) which are susceptible to calcium carbonate dissolution. In fact, a sinkhole was discovered in July 1996 in the Maggie Creek Canyon just north of the project area. The development of this feature was likely related to dewatering of the Gold Quarry pit which had lowered the water table 350 feet in the pit area (BLM, 2000a). **Figure 3-0** shows areas potentially susceptible to sinkhole development in the SOAPA area.

The site-specific risk of sinkhole development in this region will depend on both natural site conditions and hydrologic changes induced by mine dewatering and water management activities.

The project area is located in the Great Basin seismic zone. This area, characterized by northerly trending mountain ranges bounded by faults, experiences moderately high rates of seismic activity. A search of recorded earthquakes within 44 miles of the site revealed 10 events with magnitudes between 3.6 and 5.1 on the Richter Scale for the period 1901 through 1979 (Slemmons, 1983). For the period 1980 through August 31, 1997, there were two events with magnitudes of 4.4 and 4.9 (USGS, 1997).

Active fault systems, those with evidence of movement within the past 12,000 years, have been recognized to the west and south of the site. No active faults have been identified in the project area. **Table 3-1** presents the seismic characterization for the project area.

Newmont (1996) reviewed the long-term, post-reclamation seismic stability of site facilities using a seismic coefficient of 0.15g (15 percent of the acceleration of gravity). The analysis found the seismic stability of facilities to meet or exceed an acceptable factor-of-safety of 1.0.

Analyses in the previous EIS (BLM, 1993) indicated that liquefaction and surface rupture were considered unlikely and very low, respectively. All facilities, including waste rock disposal facilities and leach pads, and the earthen embankment between the pit boundary and the James Creek tailing facility are designed to withstand the maximum horizontal acceleration from seismic events as described in **Table 3-1**.

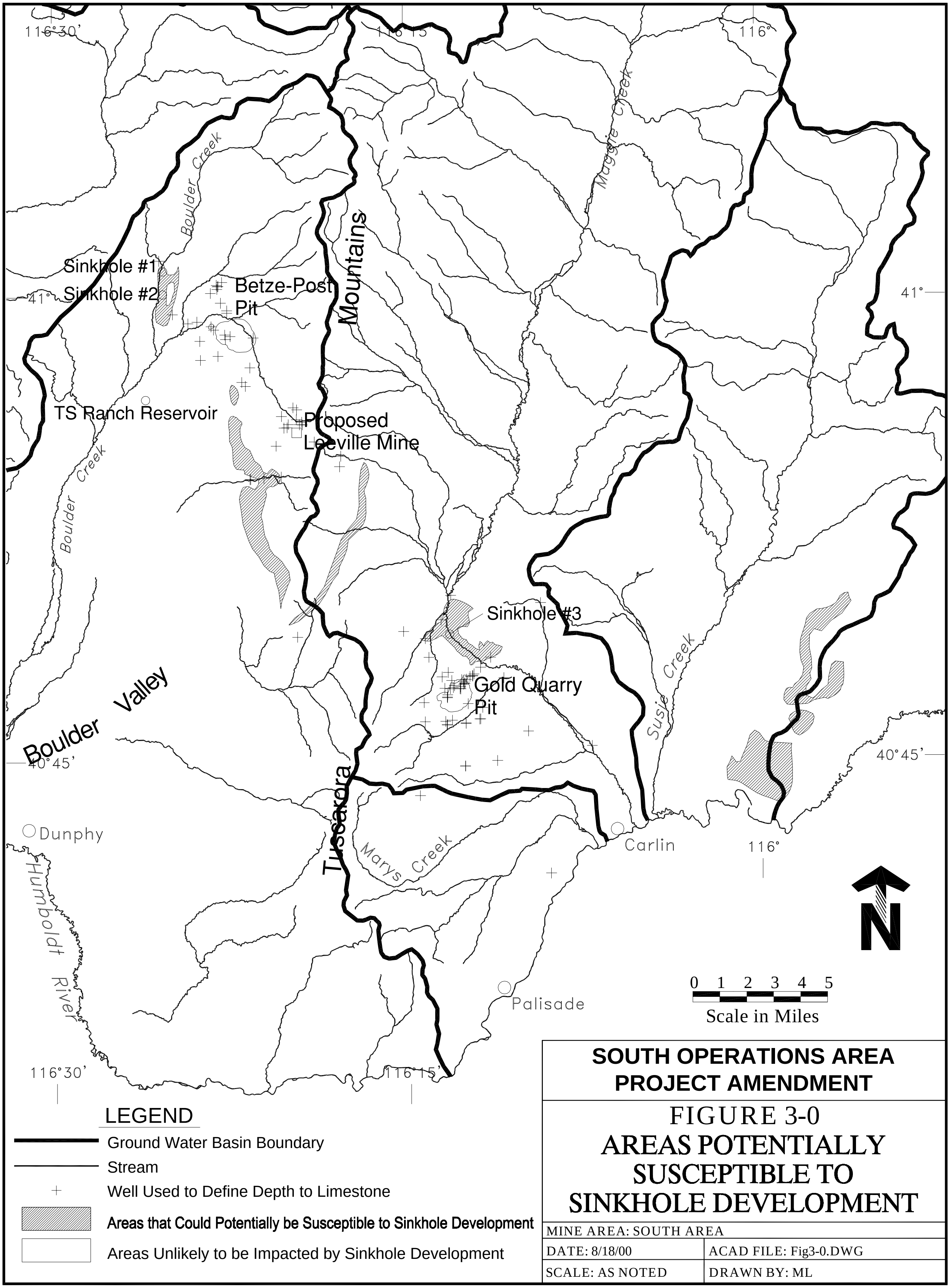
Mineral Resources

Gold mining has been the primary mineral resource recovery activity in the project area. Anticipated production for the South Operations Area was presented in Chapter 2. A complete description of mineral resources is presented in the previous EIS (BLM, 1993).

Acid Rock Drainage

The South Operations Area Project has experienced no known incidence of acid rock drainage to the environment to date. Development of refractory (sulfide) ore deposits at the South Operations Area has increased the amount of potentially acid-producing material stored in stockpiles and deposited in waste rock dump facilities. This provides a greater potential source of acid rock drainage than has existed in the past.

Minor acid rock drainage currently occurs at the Refractory Ore Stockpile adjacent to the Property Leach Pad. This drainage only occurs seasonally, is not measured by Newmont, but is captured and used in ore processing.



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-0
AREAS POTENTIALLY SUSCEPTIBLE TO SINKHOLE DEVELOPMENT

MINE AREA: SOUTH AREA	
DATE: 8/18/00	ACAD FILE: Fig3-0.DWG
SCALE: AS NOTED	DRAWN BY: ML

TABLE 3-1
SEISMIC CHARACTERIZATION FOR THE SOAPA

Assessment Method	Maximum Earthquake Magnitude (M)	Maximum Horizontal Acceleration (g)	Probability of Occurrence
Maximum Credible Earthquake from Active Fault (Slemmons, 1983)	7.2	0.42	Not applicable
Regional Probabilistic Assessment (Algermissen et al., 1982, 1990)	7.3	0.15	90% probability of not being exceeded in 50 years
	7.3	0.30	90% probability risk of not being exceeded in 250 years

Newmont samples, tests, and classifies the waste rock, in accordance with the NDEP Waste Rock and Overburden Evaluation guideline (NDEP, 1996), to determine the potential of the mined waste rock to generate acid. Potentially acid generating waste rock that is identified would be segregated, encapsulated, and monitored in accordance with Newmont's Refractory Stockpile and Waste Rock Dump Design, Construction, and Monitoring Plan (Newmont, 1997d). The agency guidelines were developed to manage potential acid rock drainage through control of the acid generation process.

Newmont has developed an extensive program designed to identify sources of potentially acid generating rock before they are removed during mining operations. This allows the planned mining of the rock and its placement in refractory rock-specific stockpiles and disposal areas that are designed to prevent vertical migration of water and to contain lateral surface flows from the waste rock dump facilities. Seven steps are followed to ensure control of any acid rock drainage: (1) segregation and placement of sulfidic wastes in internal areas of waste dumps above a prepared base; (2) total enclosure or encapsulation of the sulfidic waste zone with non-acid producing material; (3) careful sloping and random wheel compaction of individual lift surfaces; (4) control of surface water flows to prevent infiltration; (5) monitoring all ditches and berms on a quarterly basis and whenever flood conditions exist or have occurred (Newmont, 1997b); (6) placement of a low permeability cap over the final encapsulation cell; and (7) reclamation of the waste rock disposal facility, including establishing vegetation, to minimize water infiltration.

PALEONTOLOGICAL RESOURCES

Paleontological resources in the project area could include vertebrate, invertebrate, and paleobotanical fossils. Known vertebrate fossils typically are associated with Tertiary sediments, but also occur in younger Quaternary sediments. All known fossils in the project area have a relatively broad regional distribution, and are not restricted to the area of north-central Nevada.

The majority of paleontological resources identified to date on public lands in the Elko area are invertebrate fossils and have been assigned the lowest (S-3) significance ratio by Firby and Schorn (1983). Other fossils not reported in the project area, but known from geological formations that occur in the project area include Paleozoic graptolites, conodonts, brachiopods, corals, crinoids, and fishes, and Quaternary equids, camelids, and proboscids.

Previous paleontological inventory along James Creek (Clerico, 1983) reported horse, camel, and possibly lagomorph (rabbit or hare) bones exposed in and redeposited from Miocene sediments of the middle member of the Humboldt Formation (Firby, 1990). The middle member of the Humboldt Formation is also referred to as the Carlin Formation (Regnier, 1960). The outcrops containing the fossils consisted of tufaceous sandstones and silty mudstone. The upper member of the Humboldt Formation, which occurs sporadically in the project area, does not contain mammalian vertebrate fossils. In other areas of Nevada, the middle Miocene to early Pliocene Carlin Formation has yielded horse, camel, and elephant fossils, but surface evidence in the project area of such finds is sparse and does not suggest a potential for significant localities. Horse and camel fossils have also been reported from Quaternary deposits elsewhere in Nevada, but only scattered specimens from unconsolidated deposits have been reported in the general project area. The Ordovician age Vinini Formation, which has been identified at a few locations along James Creek, contains graptolite and conodont fossils at some localities, but these fossils are not generally considered significant.

During the recent archaeological inventory in the amendment area (Newsome and Tipps, 1997), archaeologists also noted locations of paleontological specimens. Previously unsurveyed and undisturbed portions of the project area were surveyed by pedestrian transect intervals of 30 meters or less for paleontological resources. A single camel foot bone was discovered in redeposited materials along Maggie Creek (Newsome and Tipps, 1997). This specimen was not considered to be a significant find.

AIR RESOURCES

Climate

The South Operations Area is located in the Maggie Creek basin airshed, a north-south valley bounded on the west by the Tuscarora Range and on the east by the Independence Mountains. The study area for SOAPA is the airshed basin. The project area is located on generally rolling terrain at elevations of 5,170 to 5,680 feet above mean sea level. The climate is classified as mid-latitude steppe, which experiences large daily temperature range, low precipitation and relative humidity, high evaporation, and limited cloud cover.

Climatic conditions such as wind speed, wind direction, precipitation, and temperature are monitored at Newmont's meteorological station. Site data have been collected since approximately 1989, however, the duration of data collection is not appropriate for accurate long-term statistical analysis. Therefore, off-site data have been used to provide more statistically reliable data.

Annual precipitation does not occur uniformly throughout the year. Generally more than half of the precipitation occurs during the five month period from October to February, primarily as winter snowfall. Most of the precipitation at the mine area occurs at high intensity, low duration thunderstorm events, or as winter snowfall. Precipitation is greater at higher elevations and snow can accumulate to considerable depths.

Precipitation in Nevada is highly dependent on altitude. Plume (1994) analyzed data for 14 stations to develop a relation between precipitation and altitude for northeastern Nevada. A linear regression resulted in the following equation: mean annual precipitation equals 0.00356 times altitude minus 8.56. This results in mean annual precipitation of 9.8 to 11.7 inches for the Gold Quarry project area for the elevations from 5,170 to 5,680 feet above mean sea level. A similar approach was followed by HCI (1999) for data from nine stations around the mine area. The HCI regression resulted in a mean annual precipitation of approximately 9.5 inches per year for the project area. Precipitation at the mine site in 1989 and 1990 averaged 7 and 7.8 inches, respectively, during a what was considered a period of drought lasting from 1989 through 1996. In 1998, precipitation was much higher than normal. The average precipitation for the years 1996 through 1999 was 11.6 inches.

The precipitation records for Elko (5,080 feet elevation), Beowawe (4,700 feet elevation) and Beowawe U of N Ranch (5,740 feet elevation) were compared for their period of record determine the mean monthly precipitation for the project site (**Table 3-2**). The precipitation at the mine site was estimated roughly to increase by 0.3 inch per month for December through May over precipitation at the Elko site, and be roughly the same for the month of June through November. Temperatures in the mine area have wide daily and seasonal variability, with daily fluctuations of 30° to 40°F common, due to high elevation, proximity to mountains, and limited cloud cover. Temperatures are warmest in July and August, and coldest in January and February (**Table 3-2**).

Figure 3-1 shows the distribution of wind velocity from data measured at the South Operation Area. The predominant wind direction is from the west-northwest throughout the year. When large-scale atmospheric pressure patterns are weak, local wind flow is affected by the heating and cooling of the Tuscarora Range. Cooler mountain air flows downslope (from the west) at night. Conversely, warmer valley air flows upslope (from the east) during the day until afternoon ground heating causes instability that results in variable wind direction and speed.

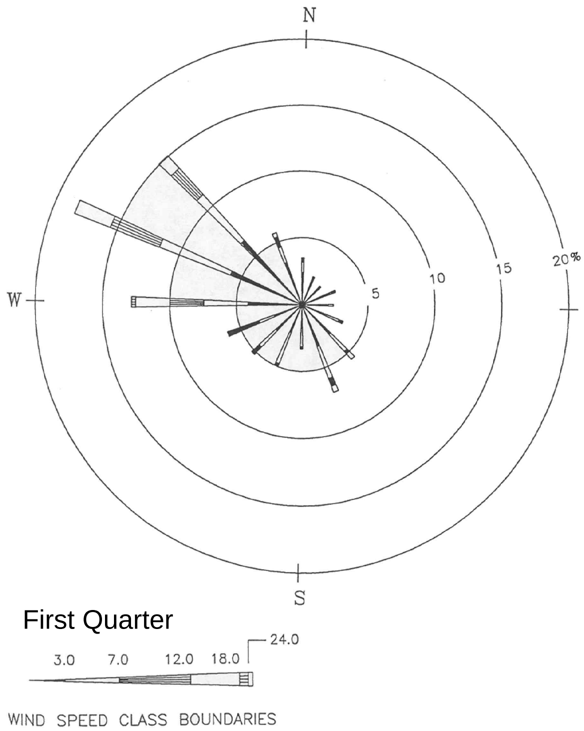
Air Quality

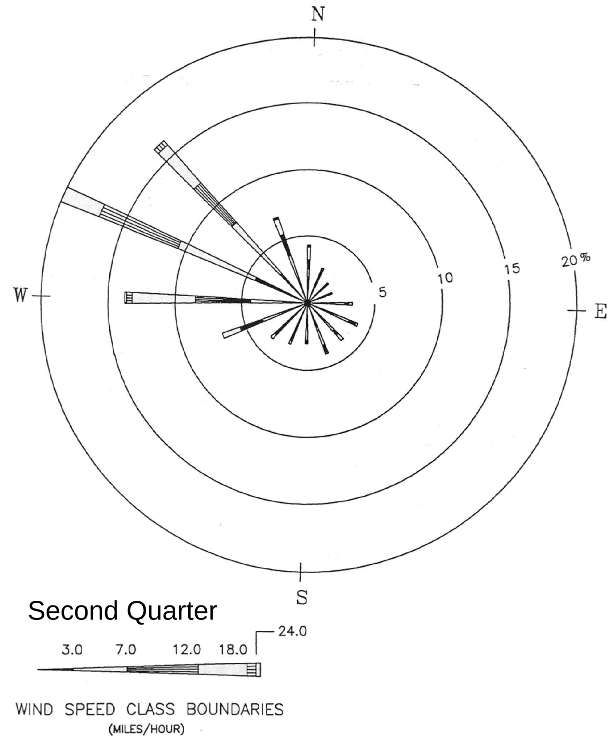
The South Operations Area is located in Maggie Creek hydrographic basin (51). Air Quality in the project area is generally good. The area is designated as unclassifiable status (ambient levels below statutory limits) for all applicable criteria pollutants (nitrogen oxides, sulfur dioxide, carbon monoxide, and particulates (PM_{10}), with an aerodynamic diameter of less than 10 microns. Monitoring is not required for lead or ozone.

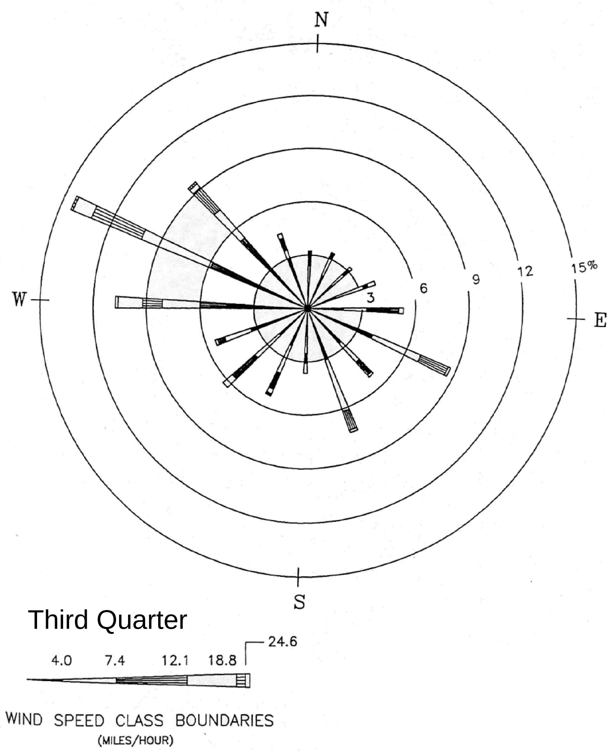
Ambient PM_{10} measurements have been recorded at the South Operations Area since 1992. No ambient measurements have been taken for the other criteria pollutants. The PM_{10} measurements have clearly demonstrated that the current mining operations are not contributing to any violations of the State of Nevada or National Ambient Air Quality Standards (NAAQS).

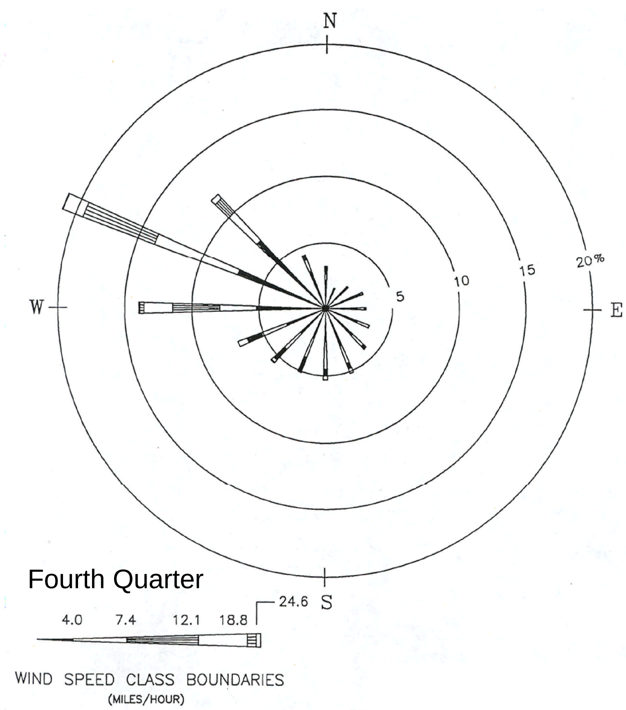
TABLE 3-2
SOAPA CLIMATOLOGY

Station	Elevation feet amsl	Period of Record		Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual
								Mean Monthly Precipitation (inches)								
SOAPA	5,300	1989		0.47	0.38	1.82	0.20	0.15	0.53	0.49	0.22	0.66	0.90	0.74	0.43	6.99
SOAPA	5,300	1990		0.50	0.29	0.47	1.69	1.02	1.10	0.23	1.23	0.17	0.12	0.62	0.35	7.79
SOAPA	5,300	1996-1999		2.32	1.08	0.76	1.16	1.52	0.90	0.33	0.24	0.65	0.66	0.85	1.14	11.61
Elko	5,080	1928-1998		1.16	0.82	0.90	0.80	1.02	0.80	0.36	0.44	0.50	0.70	0.99	1.03	9.52
Beowawe	4,700	1949-1998		0.79	0.62	0.75	0.81	1.19	0.90	0.29	0.44	0.51	0.61	0.82	0.82	8.77
Beowawe U of N Ranch	5,740	1972-1998		1.04	0.77	1.35	1.11	1.38	0.85	0.52	0.57	0.85	0.92	1.02	0.83	10.97
								Temperature °F								
SOAPA	5,300	1989	Mean	28	27	40	50	52	65	74	70	70	50	35	17	48
SOAPA	5,300	1990	Mean	21	29	41	50	54	63	77	69	60	47	35	29	48
Elko	5,080	1928-1998	Average Max	36.2	41.8	50.0	59.5	69.0	79.1	90.4	88.5	78.8	65.6	49.0	38.3	62.3
			Average Min	11.8	17.7	23.8	29.0	36.0	42.6	48.9	46.5	37.3	28.3	20.2	13.7	29.7
Beowawe	4,700	1949-1998	Average Max	40.1	46.3	53.6	62.4	72.0	81.8	91.6	89.7	80.5	67.8	51.5	41.1	65.0
			Average Min	14.6	20.6	24.9	29.4	37.0	43.9	49.7	47.2	38.5	28.7	21.5	15.2	30.9
Beowawe U of N Ranch	5,740	1972-1998	Average Max	40.0	45.8	51.2	58.9	68.1	78.4	87.3	85.9	77.6	66.0	51.0	41.9	62.8
			Average Min	13.3	19.6	25.7	29.8	36.3	43.2	49.1	47.0	39.1	29.3	21.4	14.5	30.7









Explanation: Diagram of frequency of occurrence (%) for each wind direction. Wind direction is the direction from which the wind is blowing. Example in third quarter- Wind is blowing from the North 3.2 percent of the time.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-1
1998 QUARTERLY
WIND ROSES

DATE: 6/6/00	ACAD FILE: Fig3-1.DWG
SCALE: NTS	DRAWN BY: EC, MODIFIED BY DS

The NAAQS for PM_{10} are 150 micrograms per cubic meter ($\mu g/m^3$) for a 24-hour period and 50 $\mu g/m^3$ for the annual arithmetic average. The Federal NAAQS allow one exceedance annually for the 24-hour standard. The State of Nevada does not allow any exceedances. Therefore, the South Operations Area operates under the more stringent Nevada standard. As shown on **Table 3-3**, the highest annual average was 27 $\mu g/m^3$ in 1994, and the highest 24-hour concentration was 133 $\mu g/m^3$ in 1994. Both the 24-hour maximum and the annual average in 1994 reflect the extra fugitive dust caused by **operations and wildfires in the area.** Nevertheless, these values are within the limits of the NAAQS.

Regulatory Status

The South Operations Area Project is considered a major source under the Prevention of Significant Deterioration criteria because the facility has the potential to produce emissions of at least one criteria pollutant in excess of 250 tpy.

Stationary point sources on the mine site, including Mills 5 and 6 and the South Area Leach ore crushing and material handling systems, have the potential to emit 450 tpy of PM_{10}. Gaseous emissions are approximately 260 tpy of nitrogen oxides, 220 tpy of sulfur dioxide, 120 tpy of carbon monoxide, and 40 tpy of volatile organic compounds.

Newmont has an air quality permit from the NDEP, Bureau of Air Quality, to operate all elements of the existing operation.

As part of its application for an air quality permit, Newmont completed air dispersion modeling to estimate the ambient air concentrations of criteria pollutants resulting from milling and leaching operations to include mills, kilns, crushers, boilers, and dryers. The modeling used meteorological data collected on site. Based upon the modeled results, the maximum PM_{10} ambient air concentrations outside of the permit boundary would be 59.3 $\mu g/m^3$ for a 24-hour period and 6.2 $\mu g/m^3$ for the annual average. The 24-hour maximum is 39 percent of the State of Nevada and Federal National Ambient Air Quality Standard of 150 $\mu g/m^3$, and 12 percent of the annual average standard of 50 $\mu g/m^3$. The results of the modeling (**Table 3-4**) showed that predicted concentrations of nitrogen oxides, sulfur dioxide and carbon monoxide would range from 2.7 to 9.4 percent of the NAAQS for all applicable averaging times.

PM_{10} in the form of fugitive dust is generated by mining activities such as drilling and blasting, loading of waste rock and ore, haul trucks transporting waste rock to disposal areas and ore to processing facilities, and wind-blown erosion on exposed areas. These fugitive dust emissions are reduced by Newmont's application of Best Management Practices (Handbook of Best Management Practices, Nevada State Conservation Commission, 1994). Examples of these practices include direct water application, the use of chemical binders or wetting agents, and revegetation of disturbed areas concurrent with operations. **Of the atmospheric emissions at SOAP, 13 compounds are defined as hazardous air pollutants (HAP) by the Clean Air Act. Fugitive and point source emissions for these compounds are shown in Table 3-4a.**

WATER RESOURCES

The discussion of existing water resources is divided into two sections describing the surface and groundwater systems. Each section includes a discussion of water quantity and quality.

TABLE 3-3
PM_{10} MEASUREMENTS IN THE PROJECT AREA

Year	1992	1993	1994	1995	1996
24-Hour Maximum	90	55	133	43	83
% of NAAQS	60	37	89	29	55
Date of Maximum	September 21	November 9	June 13	August 7	August 13
Annual Average	22	19	27	17	23
% of NAAQS	44	38	54	34	46

Source: McVehil-Monnett Associates, Gold Quarry PM_{10} Monitoring Consultants.

TABLE 3-4
PREDICTED AMBIENT AIR CONCENTRATIONS OF CRITERIA POLLUTANTS ASSOCIATED WITH ORE PROCESSING

Pollutant	NAAQS ($\mu g/m^3$)	Averaging Time	Predicted Concentration ($\mu g/m^3$)[4]	Percentage of NAAQS (%)
PM_{10}[1]	50	Annual	6	12.3
	150	24 Hours	59	39.5
Carbon Monoxide[2]	10000	8 Hours	272	2.7
	40000	1 Hour	1098	2.7
Nitrogen Oxide[3]	100	Annual	3.5	3.5
Sulfur Dioxide[3]	80	Annual	2.9	3.7
	365	24 Hours	29	8.1
	1300	3 Hours	122	9.4

Source:
1 Trinity Consultants, Inc., 1997.
2 Trinity Consultants, Inc., 1998.
3 Trinity Consultants, Inc., 1996.
4 Published numbers have been rounded.

TABLE 3-4a
HAZARDOUS AIR POLLUTANT DEFINED BY THE CLEAN AIR ACT

Compounds	Pounds Per Year
Antimony	**271**
Arsenic	**13,023**
Cadmium	**65**
Chromium	**62**
Cobalt	**62**
Hydrogen Cyanide	**27,000**
Lead	**79**
Manganese	**4,626**
Mercury*	**99**
Nickel	**543**
Propylene	**3,700**
Selenium	**27**
Acid Aerosols	**28**

Note: The above table reflects the 1998 TRI filed by Newmont in 1999. Newmont has since filed a revised TRI for R that indicates an 85 percent reduction of mercury compounds emitted from point sources.

*** 40 CFR 61.52 indicates for mercury mines maximum allowable air emission for mercury is 2,300 grams per 24 hour period (approximately 1850 pounds per year).**

Surface Water Hydrology

The South Operations Area Project lies within the Humboldt River Basin in northern Nevada. The Humboldt River Basin has an area of approximately 17,000 square miles and elevations range from 3,900 to 11,800 feet above mean sea level. Headwaters of the Humboldt River are located in the northeast corner of the state. The river flows westward to the Humboldt and Carson sinks located in west-central Nevada, where flow ceases due to seepage and evapotranspiration (Eakin and Lamke, 1966). Rye Patch Reservoir is a major surface water body located on the Humboldt River approximately 130 miles downstream of the town of Carlin. This reservoir has a capacity of 194,300 acre-feet **(Rye Patch 150,000 acre-feet and Pitt-Taylor 44,300 acre-feet)** and is used for recreation, fishing, boating, and irrigation in the Lovelock area.

Other major tributaries in the study area include Susie Creek, Marys Creek, and Boulder Creek. Susie and Marys creeks flow south and discharge to the Humboldt River upstream and downstream, respectively, of the Maggie Creek confluence. Boulder Creek drains southwest to its confluence with the Humboldt River east of the town of Battle Mountain.

The South Operations Area Project is located completely within the Maggie Creek drainage basin, but the study area includes adjacent basins. The headwaters of Maggie Creek are in the Independence Mountains located north of the town of Carlin. Maggie Creek flows south to its confluence with the Humboldt River east of the town of Carlin. Important tributaries to Maggie Creek in the study area (listed going upstream) include James, Soap, Simon (with tributary Lynn Creek), East Cottonwood, Jack, Little Jack, Coyote, Spring, Fish, Haskell, and Beaver creeks.

Streamflow in northern Nevada varies seasonally, with high flows typically occurring from March through June, and low flows from August through February. Some drainages or portions of drainages are ephemeral (become dry) during low-flow periods, and some are intermittent (having subsurface flows with intermittent surface flow), flowing only seasonally and in response to precipitation and/or snowmelt events. Surface water basins and monitoring station locations are shown in **Figure 3-2**.

Springs function as a connection between the groundwater and surface water hydrologic systems and provide baseflow to area drainages. Baseflow is defined as the direct groundwater contribution to streamflow. Baseflow is observed during the late fall and early winter period when agricultural diversions and evapotranspiration are minimized and groundwater contributions to streamflow are not influenced by seasonal runoff. Baseflow measurements in northern Nevada are typically recorded during the month of October. The combination of infiltration, and agricultural and domestic diversions are highest for most streams in the study area in March through May. However, Maggie Creek typically peaks in March.

In the SOAPA area, precipitation, which averages 11.6 inches annually measured at Gold Quarry (**Table 3-2**), supplies groundwater recharge and surface water to the Humboldt River Basin. Annual snowpack averages 55 inches in the mountain areas. There is no outflow from the closed Humboldt basin except through evapotranspiration. Maximum free surface evaporation is about 44 inches per year (Stone and Leeds, 1991). Approximately 85 percent of total precipitation is lost through evapotranspiration, and the remaining 15 percent is divided equally between surface runoff and groundwater recharge (Stone and Leeds, 1991). In the Maggie Creek Basin, average recharge to groundwater from precipitation amounts to approximately 23,000 acre-feet per year (Maurer, Plume, Thomas, and Johnson, 1996).

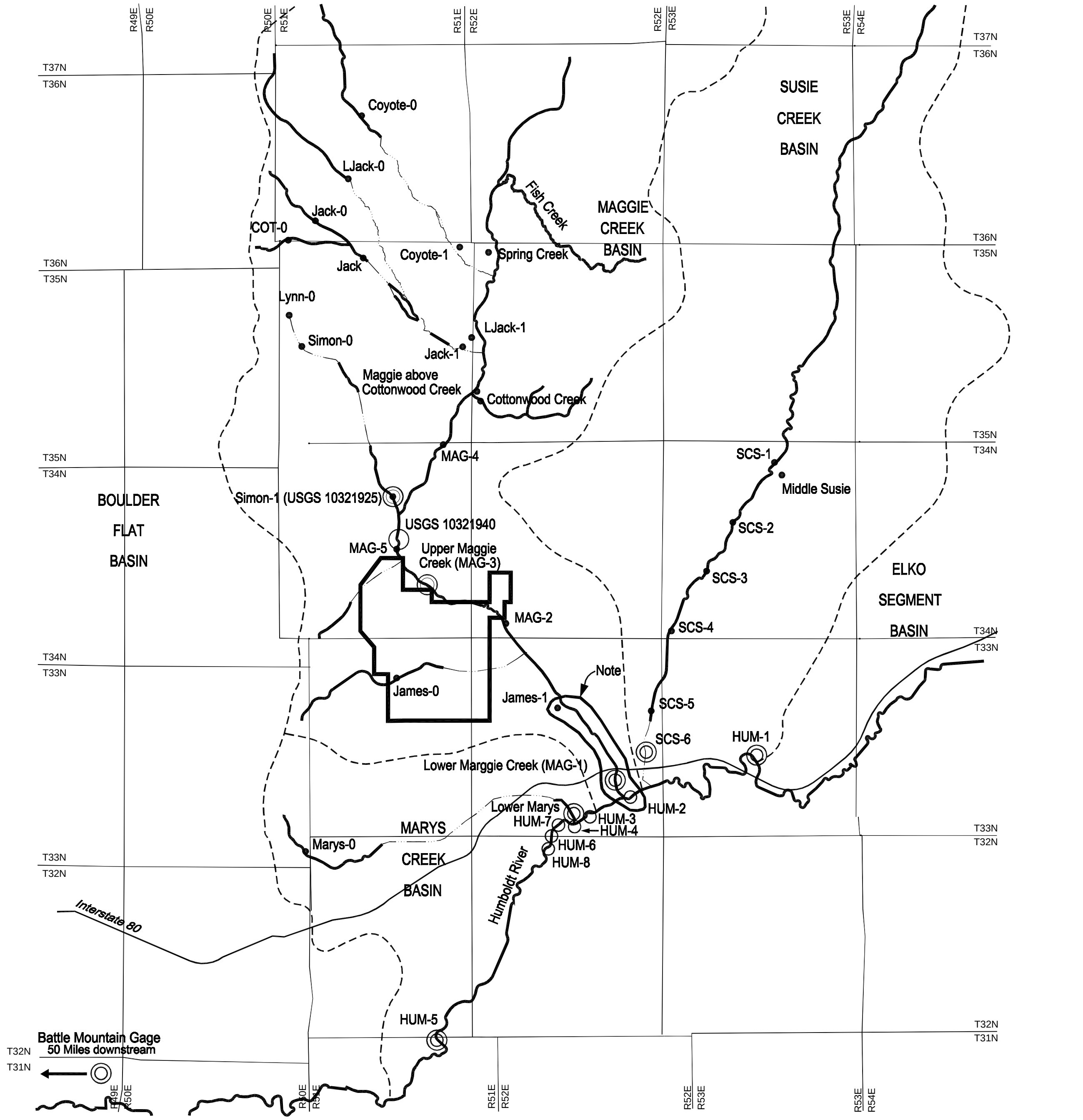
Surface Water Quantity

The U. S. Geological Survey (USGS) maintains eight surface water stations in the area including:

- two stations on the Humboldt River USGS 1032100 and 10322500;
- three stations on Maggie Creek, USGS 10321940, 10321950, and 10322000;
- one station on Marys Creek near its confluence with the Humboldt River, USGS 10322150;
- one station on Susie Creek near the Humboldt River (USGS 10321590); and
- one station on Simon Creek near its confluence with Maggie Creek (USGS 10321925).

Newmont collects flow measurements at 27 additional sites including:

- five stations on Susie Creek;
- two stations on Simon Creek;
- four stations on Maggie Creek;
- one station on upper Marys Creek;
- two stations on James Creek;
- one station on upper Lynn Creek;



LEGEND

- Flow measurement
- Water quality sampling
- U.S.G.S. gage
- South Operations Area Project
- Perennial Stream Reach
- Intermitent Streams
- Hydrologic Basins

Note:
Lower Maggie Creek is intermittent depending on water year. Has been impacted by addition of dewatering discharges.

0 2 4 6 8
Scale in Miles

Source: Newmont, 1999c; BLM, 2000b

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-2
SURFACE WATER
MONITORING LOCATIONS

MINE AREA: SOUTH AREA	
DATE: 8/1/00	ACAD FILE: Fig3-2.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

- one station on Cottonwood Creek near its confluence with Maggie Creek;
- three stations on Jack Creek;
- two stations on Little Jack Creek;
- two stations on Coyote Creek;
- one station on Spring Creek near the
- confluence with Maggie Creek;
- two stations on Welches Creek; and
- one station on Mack Creek.

Figure 3-2 shows the locations of the regional surface water monitoring stations. Hydrographs for these sites are presented in the Maggie Creek Basin Monitoring Plan (Newmont, 1999c).

Perennial Reaches in Upper Maggie Creek Basin. Perennial fall flows (or base flows) in stream reaches are supported by discharge from either the regional groundwater aquifer system or from more isolated or perched aquifers residing above the regional groundwater system**. Some stream reaches** lose water to the local water table. Flowing reaches have been monitored by Newmont in upper Maggie Creek Basin every September from 1994 through 1997 (Newmont, 1997a, 1999c). Monitored voluntarily were the flowing reaches of Jack, Simon, and part of Maggie creeks as well as reaches in Coyote, Spring, Little Jack, Indian, Cottonwood, and Lynn creeks. More streams were monitored in September 1997 than in the preceding years.

The extent of the flowing reaches in Upper Maggie Creek Basin did not change significantly from 1994 to 1997. Thus, to-date, there has been no noticeable impact from Gold Quarry dewatering on the flowing reaches. The flowing reaches in Upper Maggie Creek Basin, voluntarily monitored by Newmont in 1997, represent baseline perennial reaches for this EIS. The reach in Maggie Creek Canyon may have already been impacted by Newmont dewatering as analyzed by the BLM (1993) as discussed under the cumulative impacts in Chapter 5.

Humboldt River. The Humboldt River is the longest river in Nevada and flows entirely within the state. The river's flow in the study area has been measured by the USGS at surface water stations near Carlin (Carlin Tunnels stream gage, HUM 1) and at Palisade (HUM 5) (**Figure 3-2**). The Carlin stream gage is located approximately 5.5 miles upstream of the Maggie Creek confluence, and the Palisade gage is approximately 9 miles downstream of Maggie Creek confluence. Average annual flow at the Carlin gage ranged from 64 to 1,730 cubic feet per second (cfs) during the period 1944-98; the long-term average flow for 55 years of record is 385 cfs (USGS, 1998). Average annual flow at the Palisade gage for the period 1903-98 ranged from 35 to 1,846 cfs, with an average of 403 cfs for 96 years of record (USGS, 1998). Within the last 16 years, high flows and flooding occurred in 1983-84, followed by a period of generally below-average flow conditions, and 1995-1998 have had above average flows. **Table 3-5** summarizes maximum, minimum, and average annual flows for the Carlin Tunnels and Palisade gages for the period 1983-98.

High flows in the Humboldt River typically occur during the months of March, April, May, and June; low flows are usually measured in August, September, and October. Average monthly flows for the Humboldt River at the Palisade and Carlin gages for the period 1903-98 are presented in **Table 3-6**. Flow averages for the pre-mining years (prior to 1980), the years of large scale mining (1992-1998), and all years are included. The

**TABLE 3-5
HUMBOLDT RIVER FLOWS AT CARLIN TUNNELS AND PALISADE GAGING STATIONS FOR 1983-1998**

Water Year (Oct-Sept)	Maximum Flow (highest daily mean)		Minimum Flow (lowest daily mean)		Average Annual Flow (cfs)
	cfs[1]	Month	cfs	Month	
Carlin Tunnels Gage					
1983	6830	March	71	September	1038
1984	8090	May	135	September	1730
1985	1490	April	10	August	871
1986	5300	February	13	September	618
1987	748	May	1.2	September	150
1988	833	June	3.5	October	136
1989	1630	March	5.4	August	312
1990	1020	June	7.2	September	148
1991	1190	June	8.2	October	136
1992	314	March	4.3	July	76
1993	2890	March	12	October	396
1994	1050	May	6.6	September	128
1995	6370	June	12	October	593
1996	2580	May	16	August	495
1997	3360	June	21	October	607
1998	3270	June	48	August	641
Palisade Gage					
1983	6380	March	63	September	1261
1984	7820	May	177	September	1846
1985	1830	April	26	August	427
1986	5980	February	23	September	729
1987	768	May	13	September	172
1988	847	June	12	September	149
1989	2260	March	9.1	August	369
1990	1080	June	15	September	166
1991	1090	June	17	October	144
1992	353	March	12	July	88.5
1993	3650	March	21	December	457
1994	971	May	21	July	145
1995	5730	June	31	October	628
1996	2620	May	41	September	577
1997	3360	June	41	October	712
1998	3280	June	78	October	733

Source: USGS, 1983-1999.
[1] cfs = cubic feet per second.

TABLE 3-6
AVERAGE MONTHLY FLOW FOR THE HUMBOLDT RIVER AT PALISADE AND CARLIN GAGING STATION AND LOWER MAGGIE CREEK

Month	Average Daily Flow (cfs)								
	Humboldt River at Carlin Tunnel (Water Years 1944-1998)			Humboldt River at Palisade (Water Years 1903-1906, 1912-1998)			Maggie Creek Near Mouth (Water Years 1913-1924, 1992-1998)		
	Pre-Mining Years 1944-1991	Mining Years 1992-1998	All Years 1944-1998	Pre-Mining Years 1903-1906, 1912-1991	Mining Years 1992-1998	All Years 1903-1906, 1912-1998	Pre-Mining Years 1913-1924	Mining Years 1992-1998	All Years 1913-1924, 1992-1998
January	141.9	138.9	141.6	142.8	192.9	146.7	5.4	35.0	17.2
February	279.7	214.5	271.4	289.9	265.1	288.0	21.0	32.6	25.6
March	511.9	619.7	525.6	580.1	804.5	597.3	55.8	118.4	80.8
April	743.0	663.0	732.8	873.1	805.5	867.9	100.6	111.4	104.5
May	994.9	1132.3	1012.4	1008.2	1213.4	1024.0	98.2	89.3	94.7
June	1236.7	1542.2	1275.6	1179.5	1545.7	1207.7	19.6	37.0	26.8
July	349.6	464.6	364.3	339.7	507.9	352.6	3.5	11.8	6.7
August	52.4	73.2	55.0	59.4	91.1	61.8	2.1	9.6	5.0
September	26.3	31.3	26.9	35.7	54.4	37.2	1.4	10.5	4.9
October	45.7	33.6	44.4	58.7	61.0	58.8	4.3	13.4	7.7
November	78.4	50.5	74.8	88.8	82.4	88.3	4.4	20.0	10.3
December	101.3	72.0	97.6	106.1	103.7	105.9	3.5	21.3	10.2

Source: USGS, 1999
cfs = cubic feet per second

flows for the current mining period (since 1992) are higher than the average flows prior to 1980. Average baseflow for the Humboldt River (October measurements) is 58.8 cfs at the Palisade gage. Baseflows in the Humboldt River can vary during and between years because of the recharge/discharge dynamics of the river.

Average monthly flow during March through June (1903 to 1998) at the USGS Palisade station ranged from about 597 to 1,208 cfs. In July, average flow declined to 353 cfs. Average flow was less than 65 cfs from August through October during the same period of record. Average annual gain in flow between the Carlin and Palisade gages was 51 cfs for the period 1946-90; average baseflow gain in the same reach was 18.4 cfs (RTi, 1999). After gaining in the reach between the Carlin and Palisade stations, the Humboldt River loses an average of 126 cfs from the Palisade station to Rye Patch Reservoir due to natural phenomena (e.g., infiltration and evapotranspiration) and agricultural diversions (RTi, 1999).

Flooding in the Humboldt River Basin occurs under three typical conditions: (1) in winter as a result of rain on snow or frozen ground; (2) in spring as a result of rising temperatures that melt snow; and (3) in summer as a result of short-duration, high-intensity storms. In the Carlin area, winter and spring flows have caused the greatest flood, erosion, and sediment damage (French, Nicholson, and Cooper, 1991).

Recent flood flows **(1983 and 1984)** recorded at the Palisade gage were 6,380 cfs and 7,820 cfs, respectively. Flood-frequency data for the Humboldt River show that flow equals or exceeds 10 cfs 92 percent of the time at the Carlin gage, and 99.7 percent of the time at the Palisade gage (Stone and Leeds, 1991). A discharge rate of 1,000 cfs is exceeded 11 percent and 16 percent of the time at the Carlin and Palisade gages, respectively.

Maggie Creek. Maggie Creek flows 41 miles southward to its confluence with the Humboldt River near Carlin. The Maggie Creek drainage area is approximately 400 square miles. Immediately north of the South Operations Area, Maggie Creek is confined by Maggie Creek Canyon, or the "narrows." This bedrock feature divides the Maggie Creek Basin into upper and lower basins. Maggie Creek flows generally as a perennial stream above the canyon and as an intermittent stream through most of the lower basin.

Flow gaging on Maggie Creek by the USGS began in 1913 at a station located above its confluence with the Humboldt River (location not certain). Continuous flow monitoring at this station was discontinued in 1924.

Currently, the USGS operates three gaging stations on Maggie Creek, installed in 1989, 1992, and 1996 (**Figure 3-2**). The new station is installed in upper Maggie Creek above Maggie Creek Canyon (upstream of MAG 5), one station is located below the Narrows (MAG 3), and the lower station is located near the Humboldt River. The lower gage was replaced in April 1992 with one closer to the Humboldt River (MAG 1).

During the 1913-1924 period of record, average daily discharge of lower Maggie Creek was 26.6 cfs (USGS, 1999). Average monthly flows at the station near the Humboldt River during the period from 1913 to 1998 are presented in **Table 3-6**. In general, average monthly flow in Maggie Creek at the mouth is less than 10 cfs during 7 months of the year, and nearly 100 cfs during the months of April and May. The USGS has measured flow at several locations along Maggie Creek on the same day to evaluate water gain or loss. Flow measurements during the period 1988-92 suggest that Maggie Creek gains in flow above Maggie Creek Canyon, and loses water through and below the canyon. For example, in June 1991 flow increased from 3.2 cfs in upper Maggie Creek to approximately 7 cfs just above the canyon; flow decreased to about 5.4 cfs at the lower end of the canyon and continued to decrease to 0.14 cfs near its confluence with the Humboldt River (USGS, 1992 as seen in BLM, 1993). During periods of low streamflow, there often is no flow in Maggie Creek at its confluence with the Humboldt River.

Point flow measurements by Newmont in Maggie Creek began in Spring 1993 at two stations above Maggie Creek Canyon (MAG 4 and MAG 5), and in January 1994 in the lower basin (MAG 2) and February 1994 at Maggie Creek above Cottonwood Creek (**Figure 3-2**). Point measurements are not necessarily indicative of actual maximum flows, since high flows occur only over short time periods which might be missed with monthly measurements. However, high point flows give a good indication of flow rates commonly occurring during high flow times. Low flow rates are good indicators of baseflow rates, since low flow rates tend to be constant for a longer period of time. High flows in Maggie Creek occurred in March 1993 and March 1996, with more than 100 cfs measured at all stations. In summer and fall lower Maggie Creek commonly dries up, while upper Maggie Creek maintains flow rates of 0.2 to 0.5 cfs (**Table 3-7**).

The greatest peak discharge on record for Maggie Creek is 2,440 cfs, measured in February 1962. Based on flood frequency curves, flow without mining water discharge at the lower end of Maggie Creek is 1 cfs or more 72 percent of the time and 100 cfs or more 8 percent of the time. A flow of 13 cfs or more can be expected 25 percent of the time (Stone and Leads, 1991). A flood frequency curve for Maggie Creek is presented in **Figure 3-3**.

Susie Creek. Susie Creek is a perennial stream that flows 29 miles south to the Humboldt River and has a drainage area of approximately 212 square miles. A USGS surface water station was installed near the mouth of Susie Creek in April 1992 (SCS-6). In addition, Newmont has established five stream flow measurement sites (SCS-1 through SCS-5) along Susie Creek (**Figure 3-2**). In most years the reach near the gaging station and approximately one mile upstream is typically dry in the months July to October (Newmont, 1999c). Flow of Susie Creek at a point 16 miles above its confluence with the Humboldt River was measured by the USGS during the period 1956-58. Average annual flow at this location was about 6 cfs with average monthly flows ranging from 0.11 to 29.3 cfs (USGS, 1963). Maximum annual flows for the 3 years of measurement were 184, 161, and 89 cfs (USGS, 1963). Flow data on file with BLM show a high flow of 60 cfs recorded for April 30, 1985, at a location approximately 4 miles above Susie Creek's mouth. At the USGS surface water station on Susie Creek near its mouth, average annual flow is about 10 cfs for the period 1992 to 1998. In 1999, April flows peaked at about 424 cfs (USGS, 1999b) (**Table 3-7**).

A flood frequency curve for Susie Creek is shown on **Figure 3-3.** As a result of changes in grazing management, the lower reaches of

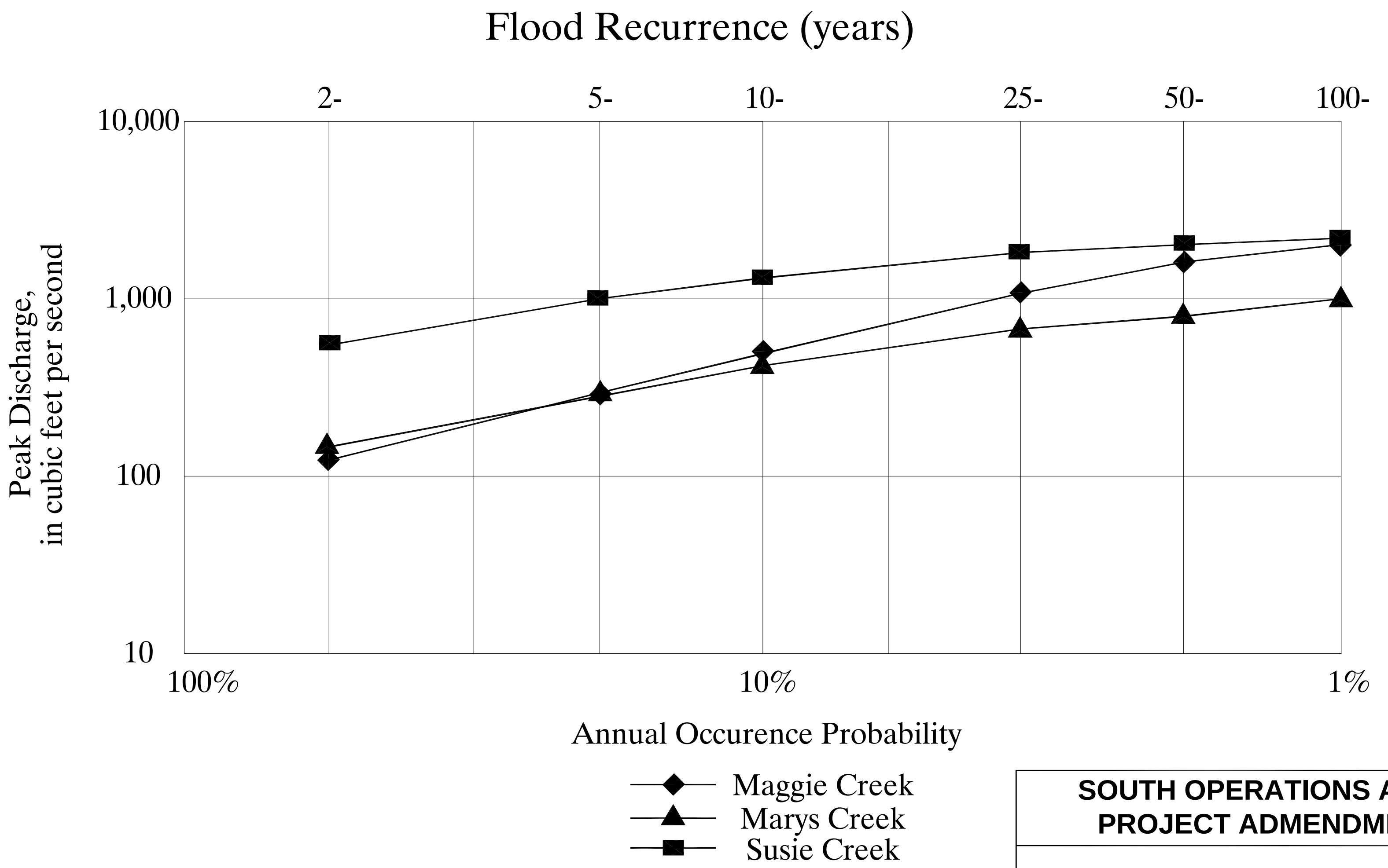
TABLE 3-7
SUMMARY OF FLOWS IN SMALL CREEKS IN SOAPA STUDY AREA THROUGH DECEMBER 1998

Gaging Station[1]	Minimum Flow (As Measured With Point Measurements[3])		High Flow (As Measured With Point Measurements[3])	
(Start of Measurements)	cfs[2]	Month-Year	cfs	Month-Year
COYOTE 0 (Jun-93)	0.2	Aug-94	43.08	May-96
COYOTE 1 (May-93)	dry	Jan-94 - May-95, Jul-95 - Feb-96, Jun-96 - Jan-97, Jul-97-Dec-97, Jul-98- Dec-98	28.61	May-96
JACK 0 (May-93)	0.058	Oct-94	4.96	May-96
JACK GS (Jun-93)	dry	Oct-94 - Jan 95	21.37	Mar-96
JACK 1 (May-93)	dry	Jun-93 - Feb-94, May-94 - Jan-96, Jun-96 - Dec-96, Jun-97 - Jan-98, Jul-98-Dec-98	24.45	Mar-96
JAMES 0 (Apr-93)	0.174	Jun-94	9.3	May-95
JAMES 1 (May-93)	dry	May-93 - Feb-95, Jun-95 - Jan-96, May-96 - Nov-96, Jun-98-Oct-98	10.03	Apr-96
LJACK 0 (May-93)	0.02	Oct-94	26.04	Mar-96
LJACK 1 (May-93)	dry	Jun-93 - Jul-93, Dec-93 - Jan-96, Jun-96 - Dec-96, Jun-97-Dec-97, Jun-98-Dec-98	19.87	Mar-96
LYNN 0 (Jul-93)	0.055	Jul-94	3.39	Mar-96
MACK 0 (Jun-93)	0.01	Aug-94	11.8	Apr-98
COTTONWOOD (Mar-94)	dry	Mar-94 - Feb-95, Aug-95 - Sep-95, Nov-95 - Jan-96, Jul-96 - Dec-96, Sep-97-Dec-97, Jun 98-Dec-98	2.16	Mar-97
MAG 1[4] (Apr-92)	dry	Jul-92 - Aug-93, Feb-93 Jan-94, Jul-94	640	Mar-93
MAG 2 (Jan-94)	dry	Jul-94 - Nov-94, Aug-95 - Sep-95, Jul-96 - Sep-96	160.57	Apr-98
MAG 3[4] (Sep-89)	dry	Jul-91-Sep-91, Jul-92-Oct-92 Jul-94-Nov-94 Aug-96	520	Mar-93
MAG 4 (Apr-93)	0.006	Sep-94	150.02	Mar-96

TABLE 3-7 (continued)
SUMMARY OF FLOWS IN SMALL CREEKS IN SOAPA STUDY AREA THROUGH DECEMBER 1998

Gaging Station[1]	Minimum Flow (As Measured With Point Measurements[3])		High Flow (As Measured With Point Measurements[3])	
MAG 5 (Mar-93)	0.45	Jul-94	354.25	Mar-93
MAG above COT (Feb-94)	0.21	Aug-94	163.18	Mar-96
MARYS 0 (Apr-93)	0.01	Oct-94	20.19	Apr-98
Lower Marys[4] (Nov-89)	0.6	Aug-91	400	Mar-93
SIMON 0 (Apr-93)	dry	Jul-93, Jul-94 - Oct-94, Jul-95 - Oct-95, Dec-95 - Aug-97, Sep-97, Dec-98	2.99	May-93
SIMON 1 (May-93)	0.072	Mar-94	10.28	Feb-94
SPRING CREEK (Jul-93)	0.303	Feb-94	12.2	May-96
SUSIE CREEK				
SCS1 (Apr-93)	1.07	Jul-93	51.58	Mar-98
SCS2 (Jun-93)	1.36	Jun-94	50.11	Mar-98
SCS3 (Jun-93)	0.76	Jun-94	35.81	Apr-96
SCS4 (Sep-93)	0.27	Jan-94	39.23	Apr-97
SCS5 (Sep-93)	dry	Jun-94 - Sep-94, Aug-95	80.86	Mar-98
SCS6[4] (Apr-92)	dry	Jun-92 - Oct-92 Jul-93 - Sep-93 Jul-94 - Oct-94 Jul-95 - Oct-95 Jul 96-Sep 96, Aug-98	424	Mar-97
WELCHES TRIB (Sep-93)	0.093	Aug-94	7.51	May-98
WELCHES 0 (May-93)	dry	Sep-94 - Dec-94	10.32	May-98

Source: Newmont, 1999c.
1 Location of the gaging stations can be found in Figure 3-2. Parentheses indicate start date of measurement.
2 cfs = cubic feet per second
3 Point measurements are not necessarily indicative of actual maximum flows, since high flows occur only over short time periods which might be missed with monthly measurements. However, maximum point flows give a good indication of flow rates commonly occurring during high flow times. Low flow rates are good indicators of base flow rates, since low flow rates tend to be constant for a longer period of time.
4 U. S. Geological Survey gage, values given are lowest daily mean and highest daily mean, data reported up to October 1998 (U. S. Geological Survey, 1999b).



Marys Creek and Susie Creek calculated after the Regression Formula.
Maggie Creek after Data in Appendix, both in Thomas et al., 1994

SOUTH OPERATIONS AREA
PROJECT ADMENDMENT

FIGURE 3-3
FLOOD FREQUENCY CURVES

DATE: 7/24/00	ACAD FILE: Fig3-3.DWG
SCALE: NTS	DRAWN BY: PBE

Susie Creek are currently in excellent condition and support an extremely productive wet meadow/beaver dam complex with flowing water and abundant wildlife use (see photos in **Appendix A**).

Marys Creek. Marys Creek flows approximately 13 miles southeast before entering the Humboldt River west of Carlin. The Marys Creek drainage area is approximately 75 square miles. A continuous-recording USGS stream gage has been operating on Marys Creek below Carlin Springs since November 1989 (Lower Marys). The gage shows maximum and minimum daily discharges of 400 and 0.6 cfs, respectively (USGS, 1999) (**Table 3-7**). Flow at the surface water station typically shows a sharp decline in April or May corresponding to the cessation of surface water runoff from Marys Mountain (Newmont, 1999c). The town of Carlin obtains its municipal water from the springs, which affects flow measurements downstream at the gaging station.

Newmont conducts point measurements at Upper Marys Creek (Mary 0). The flow is intermittent with high flows typically recorded in March and April and low flows in October and November. In 1998, April flows were measured at about 20 cfs. In October 1994, low flows were about 0.01 cfs (Newmont, 1999c). Trench et al. (1991) calculated that a 100-year flood on Marys Creek would produce a scale flow of 2,600 cfs at the Interstate 80 bridge, according to the equation in Thomas (1994). The 100-year flood would produce a peak flow of around 1,000 cfs. A flood frequency curve for Marys Creek is shown on **Figure 3-3**.

James, Soap, Simon, Cottonwood, Jack, Little Jack, Coyote, Spring, Haskell, Beaver, Fish, and Taylor creeks. All of these creeks are intermittent tributaries of Maggie Creek north of the South Operations Area except for James Creek which is also a tributary of Maggie Creek, but is located on the southern end of the South Operations Area. Several of the Maggie Creek tributary drainages are typically dry or are outside the area of potential impacts and are not monitored including Haskell, Beaver, Fish, and Taylor creeks.

James Creek flows for about 6 miles southeast to its confluence with Maggie Creek. Upper James Creek as measured at station James 0 is perennial with maximum flows in March and low flows in October. In 1995, May flows were measured at about 9.3 cfs and low flows in June 1994 were approximately 0.2 cfs (Newmont, 1999c). James Creek at its confluence with Maggie Creek (JAMES 1) is dry most of the year (Newmont, 1999c) (**Table 3-7**).

Simon Creek flows for about 7 miles southeast to its confluence with Maggie Creek. Simon Creek is typically ephemeral in its upper reaches and perennial at its mouth as recorded at monitoring stations Simon 0 and Simon 1, respectively. The USGS began operating a surface water station at the mouth of Simon Creek in November 1996, which replaced Newmont's Simon 1 station. In lower Simon Creek (Simon 1), peak flow generally occurs in February and March and low flows are in July through October. In 1994, flow was measured in February at a rate of about 10 cfs, and then dropped rapidly to about 0.07 cfs by March. In 1996, September flows were about 0.6 cfs. Lynn Creek is a tributary to Simon Creek and flows about eight miles southeast to its confluence near Maggie Creek. Data for Lynn Creek (Lynn 0) indicate peak flows in March and low flows in July through December. In 1996, flows of about 3.4 cfs were measured in mid-March with low flows of about 0.06 cfs in July through December (**Table 3-7**).

Cottonwood Creek flows for about 6 miles southwest to its confluence with Maggie Creek. Cottonwood Creek is ephemeral with maximum flows in March or April. Cottonwood Creek is normally dry from August through January. In 1997, flows of about 2 cfs were recorded in mid-March. In 1996, the stream was dry from late-July through mid-December (**Table 3-7**).

Jack Creek flows for about 10 miles southeast to its confluence with Maggie Creek. Jack Creek has two named tributaries, West Cottonwood Creek and Indian Creek. Data from Upper Jack Creek at monitoring station Jack 0 shows perennial flow while data from lower Jack Creek above Maggie Creek (Jack 1) indicate ephemeral flow. Middle Jack (Jack GS) is ephemeral. In 1996, the peak flow in lower Jack Creek was about 24 cfs in mid-March. Lower Jack Creek was dry from mid-June through early December (**Table 3-7**).

Little Jack Creek parallels Jack Creek to the north, flowing about 13 miles to its confluence with Maggie Creek. Data from Upper Little Jack Creek at monitoring station LJack 0 indicate perennial flow while data from lower Little Jack Creek above Maggie Creek (LJack 1) indicate ephemeral flow. In 1996, the high flow in lower Little Jack Creek was about 20 cfs in mid-March. Little Jack Creek was dry from mid-June through early December (**Table 3-7**).

Fish Creek is a small west-draining tributary to Maggie Creek upstream of Little Jack Creek. A monitoring station has not been established on Fish Creek. However, an aquatic habitat survey (JBR, 1992b) indicates mean flow of the intermittent stream is 0.185 cfs.

Coyote Creek is the first drainage north of Fish Creek. Coyote Creek flows for about 11 miles southeast to its confluence with Maggie Creek. Data from upper Coyote Creek at monitoring station Coyote 0 indicate perennial flow while data from lower Coyote Creek above Maggie Creek (Coyote 1) indicate ephemeral flow. In 1996, the high flow in lower Coyote Creek was about 29 cfs in mid-May. Lower Coyote Creek was dry from mid-June through late January (**Table 3-7**).

Spring Creek is a small drainage directly north of Coyote Creek. Spring Creek flows southeast for approximately 2 miles to Maggie Creek. Flow data from a monitoring station located near the mouth of Spring Creek show perennial flow. In 1996, the high flow was about 12 cfs in May. In 1994, a low flow was recorded in February at about 0.3 cfs (**Table 3-7**).

Flow data are not available for Haskell, Beaver, or Taylor creeks.

Welches and Mack creeks. These creeks drain into the Boulder Flat Drainage Basin. Both streams are perennial in the upper reaches and ephemeral in the lower reaches. Flow data from Lower Welches (Welches 0) show a high flow of about 10.3 cfs in May 1998. Lower Welches was dry from September to December 1994. High flow in Mack Creek was about 12 cfs in April 1998 and low flows were recorded in August 1994 at about 0.01 cfs (**Table 3-7**).

Surface Water Quality

Surface water in the upper Humboldt River Basin is generally a calcium-bicarbonate type with hardness and pH ranges of 100 to 250 milligrams per liter (mg/L) and 6.5 to 9.0, respectively. Total dissolved solids generally are less than 500 mg/L. Dissolved oxygen typically is in the range of 2.4 to 15 mg/L (Newmont, 1999c). Newmont (1999c) has collected surface water samples since April 1990 from four sites on Maggie Creek and eight sites on the Humboldt River. Newmont currently monitors surface water on the Humboldt River at two sites only (HUM-1 and HUM-5) (**Figure 3-2**). The USGS **monitors surface water at the Battle Mountain gage and** also collects water quality samples at selected streams and the Humboldt River in the study area. Relatively little variation in chemistry occurs during the low and high flow regimes, and when comparing samples collected from upstream and downstream stations. **Table 3-8** contains a summary of water quality data from the Newmont monitoring stations on the Humboldt River and Maggie Creek.

Naturally occurring concentrations of metals in surface water in the project area are generally low or do not exceed detection limits. However, several trace metals measured in the Humboldt River and/or Maggie Creek have exceeded drinking water quality standards, including silver, cadmium, chromium, iron, manganese and lead, **or aquatic life standards (silver, cadmium, chromium, iron, mercury, manganese, lead, selenium, and zinc)(Table 3-8)**.

A summary of the water samples collected between 1992 and **1998** from Jack, Simon, Marys, and Susie creeks is presented in **Table 3-9**. In all four creeks, concentrations of iron and manganese higher than the drinking water standards were measured. Simon Creek also exceeded drinking water standards for arsenic and selenium.

Temperature of surface water in the project area varies considerably throughout the year, and seems to be more dependent on ambient air temperature than discharge rate. During summer, water temperatures in Maggie Creek and the Humboldt River typically are in the range of 15° to 25°C (**Table 3-10**). In winter, surface water temperatures generally are less than 10°C. An exception is temperature at station HUM-6, which is much higher due to the Carlin Hot Springs discharge into the river. Maximum recorded water temperatures in Maggie Creek and the Humboldt River (except at HUM-6) during the period 1994-98 is 26.0°C. Water temperature in Maggie Creek generally increases downstream; for example, in March 1996, Maggie Creek temperature was 9.5°C north of the South Operations Area and 11.3°C near its confluence with the Humboldt River. Temperature variations along the Humboldt River are less pronounced in the project area; however, temperature increases typically are observed in the river for a short distance downstream of the Carlin Hot Spring (station HUM-6, **Figure 3-2**).

Water quality data indicate some seasonal variation in TDS and turbidity with relatively high concentrations in the spring or high flow period and lower concentrations during late summer to early winter low flow periods. These variations may reflect snowmelt versus groundwater (Eakin and Lamke, 1966).

TABLE 3-8
SUMMARY OF WATER QUALITY FOR MAGGIE CREEK AND HUMBOLDT RIVER

Monitoring Site[1] (Period of Record)	Total Concentration Statistics[2,3]	Temp °C	pH SU	Alk mg/l	Cond uMHOS/cm	Hard mg/l	TDS mg/l	TSS mg/l	Turb NTU	Ag mg/l	As mg/l	Ba mg/l	Cd mg/l	Cr mg/l	DO mg/l	Cu mg/l	Fe mg/l	Hg mg/l	Mn mg/l	Pb mg/l	Se mg/l	Zn mg/l
	No. of Samples	32	31	16	32	9	33	33	30	13	34	10	17	31		31	34	17	30	34	33	33
	Minimum	5.1	7.35	100	320	120	222	bdl	bdl	bdl	bdl	bdl	bdl	bdl	4.400	bdl	bdl	bdl	bdl	bdl	bdl	bdl
MAG-1	Average	15.6	8.33	199	511	189	335	74.4	22.85	0.004	0.013	0.15	0.003	0.011	7.720	0.006	1.09	0.0002	0.08	0.007	0.003	0.020
(1990-1998)	Maximum	24.5	9.00	253	705	217	410	1100.0	280.00	0.005	0.033	0.86	0.005	0.022	12.160	0.064	30.00	0.0004	0.93	0.060	0.001	0.270
	No. above Detection Limit	32	31	16	32	9	33	25	29	1	32	7	1	3		8	30	3	25	3	2	17
	No. above Water Standard[4]	0	6	0	0	0	0	5	5	0	0	0	1	1		0	8	3	6	3	0	1
	No. of Samples	22	22	11	22	11	25	26	22	13	26	9	17	22		22	26	17	22	26	18	26
	Minimum	0.0	6.90	95	239	120.00	230	bdl	bdl	bdl	bdl	bdl	bdl	bdl	2.990	bdl	0.02	bdl	bdl	bdl	bdl	bdl
MAG-2	Average	12.6	8.25	185	453	186.91	339	57.4	18.69	bdl	0.009	0.173	bdl	0.011	7.020	0.008	1.45	0.00	0.08	0.007	0.011	0.021
(1990-1996)	Maximum	25.7	9.10	229	702	220.00	580	1000.0	280.00	bdl	0.019	0.920	bdl	0.022	11.860	0.065	31.00	0.00	0.93	0.017	0.008	0.280
	No. above Detection Limit	21	22	11	22	11	25	20	21	0	23	7	0	3		5	26	3	17	2	4	18
	No. above Water Standard[4]	0	5	0	0	0	1	3	2	0	0	0	0	1		0	7	3	6	2	1	1
	No. of Samples	33	33	19	33	12	36	37	32	15	36	11	18	33		33	37	18	33	37	37	37
	Minimum	0.2	7.20	90	8	102	221	bdl	bdl	bdl	bdl	bdl	bdl	bdl	3.200	bdl	bdl	bdl	bdl	bdl	bdl	bdl
MAG-3	Average	12.2	8.28	170	466	174	319	45.3	16.25	bdl	0.007	0.12	0.004	0.008	8.520	0.005	0.84	0.0002	0.08	0.005	0.003	0.014
(1990-1998)	Maximum	24.4	10.00	217	1424	217	490	650.0	180.00	bdl	0.014	0.62	0.010	0.015	14.730	0.044	21.00	0.0003	0.62	0.011	0.003	0.190
	No. above Detection Limit	33	33	19	33	12	36	28	31	0	30	8	3	4		7	36	3	29	2	3	21
	No. above Water Standard[4]	0	6	0	0	0	0	6	4	0	0	0	3	1		0	9	3	10	2	0	1
	No. of Samples	30	31	24	29	16	34	35	31	19	35	15	24	31		31	35	24	31	35	35	35
	Minimum	0.3	6.96	80	111	110	217	bdl	bdl	bdl	bdl	bdl	bdl	bdl	3.100	bdl	bdl	bdl	bdl	bdl	bdl	bdl
MAG-4	Average	11.0	8.23	158	398	177	308	24.1	10.06	0.004	0.003	0.08	0.003	0.009	7.890	0.007	0.59	0.0002	0.04	0.006	0.003	0.044
(1990-1996)	Maximum	23.5	9.50	205	613	196	800	290.0	160.00	0.011	0.012	0.33	0.006	0.009	12.400	0.087	14.00	0.0003	0.35	0.017	0.012	0.738
	No. above Detection Limit	30	31	24	29	16	34	27	30	1	7	10	2	3		5	32	5	24	7	5	19
	No. above Water Standard[4]	0	5	0	0	0	1	3	4	1	0	0	2	0		0	7	5	5	7	1	3
	No. of Samples	39	39	25	38	16	42	43	38	21	43	17	24	39		39	43	25	39	43	43	43
	Minimum	0.4	7.06	141	106	110	182	bdl	1.00	bdl	bdl	bdl	bdl	bdl	4.170	bdl	bdl	bdl	bdl	bdl	bdl	bdl
HUM-1	Average	12.1	8.15	190	412	149	284	91.8	34.21	0.008	0.006	0.12	0.003	0.009	8.300	0.007	1.26	0.0002	0.10	0.006	0.003	0.016
(1990-1998)	Maximum	24.1	8.72	230	621	190	356	771.0	260.00	0.096	0.019	0.54	0.006	0.018	15.340	0.036	24.00	0.0006	0.69	0.014	0.005	0.097
	No. above Detection Limit	39	39	25	38	16	42	40	38	1	33	16	1	5		14	42	5	37	8	1	30
	No. above Water Standard[4]	0	2	0	0	0	0	23	21	1	0	0	1	1		0	24	5	21	8	0	0
	No. of Samples	29	29	19	29	14	31	32	29	17	32	14	21	29		29	32	21	29	32	32	32
	Minimum	1.0	7.10	130	111	120	217	bdl	0.80	bdl	bdl	bdl	bdl	bdl	4.200	bdl	bdl	bdl	bdl	bdl	bdl	bdl
HUM-2	Average	13.0	8.12	194	447	164	311	84.7	28.59	0.005	0.008	0.14	0.004	0.012	7.270	0.006	1.44	0.0002	0.09	0.007	bdl	0.014
(1990-1996)	Maximum	22.0	8.63	232	692	238	390	850.0	300.00	0.012	0.018	0.57	0.021	0.100	11.100	0.031	25.00	0.0004	0.77	0.015	bdl	0.100
	No. above Detection Limit	29	29	19	29	14	31	29	29	2	27	12	1	6		9	31	4	27	6	0	17
	No. above Water Standard[4]	0	1	0	0	0	0	16	13	1	0	0	1	2		0	17	4	15	6	0	0
	No. of Samples	29	29	21	30	13	32	33	29	17	33	13	21	29		29	33	21	29	33	33	32
	Minimum	0.6	7.20	110	116	110	217	bdl	0.80	bdl	bdl	bdl	bdl	bdl	3.700	bdl	bdl	bdl	bdl	bdl	bdl	bdl
HUM-3	Average	12.3	8.12	191	438	151	316	298.2	31.05	0.005	0.008	0.15	0.004	0.011	7.180	0.008	1.68	0.0002	0.11	0.008	0.003	0.018
(1990-1997)	Maximum	24.0	8.50	227	635	184	414	7100.0	300.00	0.014	0.018	0.68	0.013	0.021	11.600	0.050	28.00	0.0009	0.81	0.035	0.012	0.160
	No. above Detection Limit	29	29	21	30	13	32	29	29	2	28	11	2	6		10	32	3	27	7	1	20
	No. above Water Standard[4]	0	0	0	0	0	0	16	14	1	0	0	2	1		0	18	3	19	7	1	1
	No. of Samples	26	29	22	26	14	31	32	29	18	33	15	22	30		30	33	22	30	33	33	32
	Minimum	2.0	7.14	120	128	120	219	bdl	0.80	bdl	bdl	bdl	bdl	bdl	3.690	bdl	0.05	bdl	bdl	bdl	bdl	bdl
HUM-4	Average	14.4	8.08	196	450	157	321	90.9	29.77	0.004	0.009	0.14	0.004	0.012	7.520	0.008	1.62	0.0002	0.10	0.006	bdl	0.021
(1990-1996)	Maximum	24.2	8.51	240	629	200	450	1100.0	300.00	0.005	0.030	0.71	0.009	0.100	10.100	0.050	31.00	0.0008	0.89	0.017	bdl	0.160
	No. above Detection Limit	26	29	22	26	14	31	26	29	1	31	13	3	5		10	33	3	29	4	0	20
	No. above Water Standard[4]	0	1	0	0	0	0	18	16	0	0	0	3	2		0	18	3	20	4	0	1
	No. of Samples	37	38	25	38	16	41	42	37	21	42	17	24	38		38	42	24	38	42	42	42
	Minimum	1.7	7.15	130	272	110	170	bdl	0.70	bdl	bdl	bdl	bdl	bdl	4.050	bdl	0.04	bdl	bdl	bdl	bdl	bdl
HUM-5	Average	13.4	8.17	192	440	150	302	120.4	43.17	0.004	0.007	0.15	0.003	0.018	8.510	bdl	1.57	0.0002	0.10	0.007	0.003	0.018
(1990-1998)	Maximum	23.0	8.50	229	636	185	372	1200.0	351.00	0.018	0.020	0.86	0.005	0.380	14.340	0.047	36.00	0.0008	1.00	0.050	0.005	0.180
	No. above Detection Limit	37	38	25	38	16	41	39	37	1	35	15	2	4		11	42	3	36	8	1	28
	No. above Water Standard[4]	0	0	0	0	0	0	22	18	1	0	0	2	2		0	22	3	18	8	0	1

TABLE 3-8
SUMMARY OF WATER QUALITY FOR MAGGIE CREEK AND HUMBOLDT RIVER

Monitoring Site[1] (Period of Record)	Total Concentration Statistics[2,3]	Temp °C	pH SU	Alk mg/l	Cond uMHOS/cm	Hard mg/l	TDS mg/l	TSS mg/l	Turb NTU	Ag mg/l	As mg/l	Ba mg/l	Cd mg/l	Cr mg/l	DO mg/l	Cu mg/l	Fe mg/l	Hg mg/l	Mn mg/l	Pb mg/l	Se mg/l	Zn mg/l
HUM-6 (1991-1996)	No. of Samples	25	26	18	25	14	25	26	26	14	26	14	17	26		26	26	17	26	26	26	26
	Minimum	8.7	6.75	130	300	120	218	bdl	bdl	bdl	bdl	0.11	bdl	bdl	2.400	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	Average	44.0	7.88	241	694	171	368	91.7	27.53	0.004	0.011	0.26	0.003	0.013	4.720	0.008	1.54	0.0002	0.11	0.007	0.003	0.022
	Maximum	75.5	8.28	312	1200	195	452	1000.0	300.00	0.005	0.027	0.65	0.007	0.130	9.980	0.050	27.00	0.0003	0.90	0.020	0.009	0.140
	No. above Detection Limit	25	26	18	25	14	25	24	25	1	24	14	3	3		7	25	4	23	4	1	16
	No. above Water Standard[4]	0	0	0	0	0	0	12	10	0	0	0	3	2		0	13	4	13	4	1	0
HUM-7 (1991-1996)	No. of Samples	24	25	18	24	15	24	25	25	15	25	15	16	25		25	25	16	25	25	25	25
	Minimum	5.4	7.70	120	295	119	210	bdl	1.70	bdl	bdl	bdl	bdl	bdl	3.440	bdl	0.09	bdl	bdl	bdl	bdl	bdl
	Average	15.8	8.13	189	440	154	310	113.5	33.69	bdl	0.009	0.15	0.00	0.009	7.530	0.007	1.89	0.0001	0.11	0.007	0.003	0.033
	Maximum	29.7	8.41	226	740	190	395	990.0	280.00	bdl	0.036	0.68	0.01	0.020	12.660	0.041	28.00	0.0002	0.85	0.050	0.005	0.326
	No. above Detection Limit	24	25	18	24	15	24	24	25	0	20	13	1	3		10	25	3	24	5	1	16
	No. above Water Standard[4]	0	0	0	0	0	0	16	14	0	0	0	1	1		0	18	3	18	5	0	2
HUM-8 (1991-1996)	No. of Samples	26	28	21	27	13	27	28	28	14	28	14	17	28		28	28	17	28	28	28	28
	Minimum	5.9	7.10	130	298	119	224	bdl	0.70	bdl	bdl	bdl	bdl	bdl	3.900	bdl	0.07	bdl	bdl	bdl	bdl	bdl
	Average	15.9	8.05	200	454	155	311	98.5	30.94	bdl	0.011	0.15	0.00	0.011	7.020	0.024	1.70	0.0002	0.10	0.007	0.003	0.026
	Maximum	29.5	8.46	301	606	190	380	1000.0	320.00	bdl	0.050	0.72	0.01	0.020	10.700	0.040	29.00	0.0008	0.89	0.018	0.002	0.150
	No. above Detection Limit	26	28	21	27	13	27	27	28	0	26	12	2	5		10	28	4	27	3	1	16
	No. above Water Standard[4]	0	0	0	0	0	0	14	13	0	0	0	2	1		0	16	4	20	3	0	1
Maximum Detection Limit		NR	NR	NR	NR	NR	NR	5	0.50	0.050	0.005	0.10	0.010	0.100		5.000	0.05	0.0010	0.05	0.050	0.100	0.025
Drinking Water Standards[5]			6.5-8.5 (s)				500(s)			0.050	0.050	2.0	0.005	0.100		1.3	0.3(s)	0.002	0.05(s)	0.05	0.05	5.0(s)
Aquatic Life Standards[6]			6.5-9.0					25-80	10	0.009	0.18(d)-0.34(d)		0.0015(d)-0.006(d)	0.01(d)-0.015(d)		16.1(d)-25.3(d)	1.0	0.000012(d)-0.002		0.0016(d)-0.08(d)	0.005-0.02	0.145(d)-0.160(d)

Source: Newmont, 1999; NAC 445A.144

[1] See Figure 3-2 for location of monitoring sites; MAG-1 through MAG-4 are located on Maggie Creek, HUM-1 through HUM-8 are located on the Humboldt River; HUM-6 is located where Carlin Hot Spring discharges into the Humboldt River. All four stations on Maggie Creek are within the Class C designation; all stations on the Humboldt River, except HUM-5 (Palisade), are withing the Palisade control point designation.

[2] Average values were calculated assuming half detection limit for values below detection limit.

[3] Samples collected generally quarterly; Alk. = Alkalinity; Cond. = Conductivity (field); Hard. = Hardness; TDS = total dissolved solids; TSS = total suspended solids; Turb. = turbidity; Ag = silver; As = arsenic; Ba = barium; Cd = cadmium; Cr = chromium; DO = dissolved oxygen (field measured); Cu = Copper; Fe = iron; Hg = mercury; Mn = manganese; Pb = lead; Se = selenium; Zn = zinc; °C = degree celsius; SU = standard pH units (lab measured); mg/l = milligrams per liter; uMHOS/cm = microhoms per cemtimenter; NTU = nephelometric turbidity units; bdl = below detection limits.

[4] Based on strictest standard.

[5] All concentrations reported are primary drinking water standards unless followed by (s) indicating secondary standards.

[6] All standards for metals are for total recoverable, unless noted with (d) for dissolved fraction.

Ag, Cd, Cu, Pb, and Zn concentration standards are calculated based on a hardness of 175 mg/l, representative of Maggie Creek and the Humboldt River.

For As, Cd, Cr, Cu, Hg, Pb, Se, and Zn low values are 96-hour average concentration limits, high values are 1-hour average concentration limits. Both may be exceeded only once every 3 years.

For Ag and Fe single concentration limits must not be exceeded.

TABLE 3-9
SUMMARY OF WATER QUALITY FOR JACK CREEK, MARY'S CREEK, SIMON CREEK, AND SUSIE CREEK

Monitoring Site[1] (Period of Record)	Total Concentration Statistics[2,3]	Temp °C	pH SU	Alk mg/l	Cond uMHOS/cm	Hard mg/l	TDS mg/l	TSS mg/l	Turb NTU	Ag mg/l	As mg/l	Ba mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Fe mg/l	Hg mg/l	Mn mg/l	Pb mg/l	Se mg/l	Zn mg/l
Jack Creek (1992-1996)	No. of Samples	17	18	11	18	4	17	18	18	4	18	4	7	18	18	18	7	18	18	18	18
	Minimum	1.8	7.05	50	97	84	128	bdl	0.30	bdl	bdl	0.06	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	Average	12.9	8.18	123	352	175	237	29.7	6.88	0.004	0.004	0.10	bdl	bdl	0.005	0.63	0.0003	0.03	0.007	0.002	0.014
	Maximum	23.2	9.76	150	443	210	290	174.0	44.00	0.009	0.013	0.17	bdl	0.005	0.028	6.20	0.0003	0.25	0.020	0.002	0.095
	No. above Detection Limit	17	18	11	18	4	17	10	18	1	7	4	0	3	3	16	2	13	2	3	10
	No. above Water Standard[4]	0	1	0	0	0	0	4	3	0	0	0	0	0	0	4	2	2	2	0	0
Marys Creek (1992-1998)	No. of Samples	25	25	11	24	2	24	25	24	4	25	4	7	25	25	25	7	25	25	25	25
	Minimum	0.2	7.07	90	228	140.00	150	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	Average	13.7	8.04	189	465	215.00	300	130.7	40.64	bdl	0.004	0.083	bdl	bdl	0.006	0.23	bdl	0.08	0.006	0.004	0.021
	Maximum	26.0	8.55	245	670	290.00	426	1970.0	486.00	bdl	0.009	0.150	bdl	0.005	0.053	1.19	bdl	1.46	0.010	0.010	0.262
	No. above Detection Limit	25	25	11	24	2	24	18	23	0	13	3	0	1	4	22	0	19	2	10	17
	No. above Water Standard[4]	0	1	0	0	0	0	5	4	0	0	0	0	0	0	5	0	2	2	4	1
Simon Creek (1993-1998)	No. of Samples	21	21	6	21	1	20	21	19	3	21	3	5	21	21	21	5	21	21	21	21
	Minimum	3.2	7.49	75	77	400	351	bdl	0.50	bdl	0.008	0.10	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	Average	13.0	8.20	211	1264	400	827	39.2	13.17	bdl	0.036	0.12	bdl	bdl	0.004	0.30	0.0004	0.04	0.005	0.024	0.009
	Maximum	25.3	8.58	280	2400	400	1950	292.0	61.90	bdl	0.300	0.17	bdl	0.006	0.012	2.50	0.0002	0.13	0.008	0.440	0.026
	No. above Detection Limit	21	21	6	21	1	20	20	19	0	21	3	0	1	5	19	1	13	2	3	10
	No. above Water Standard[4]	0	2	0	0	0	14	7	7	0	1	0	0	0	0	4	1	8	2	2	0
Susie Creek (1992-1998)	No. of Samples	21	21	7	21	2	20	21	20	4	21	4	5	20	21	21	5	21	21	21	21
	Minimum	0.0	7.40	90	198	80	141	bdl	0.40	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	Average	12.0	8.20	161	446	130	289	208.8	63.86	bdl	0.007	0.22	bdl	0.006	0.006	1.95	0.0003	0.10	0.006	bdl	0.014
	Maximum	28.2	8.65	223	616	180	388	1640.0	413.00	bdl	0.014	0.63	bdl	0.017	0.040	32.00	0.0001	0.88	0.026	bdl	0.120
	No. above Detection Limit	20	21	7	21	2	20	16	20	0	17	3	0	1	3	19	1	20	4	0	11
	No. above Water Standard[4]	0	5	0	0	0	0	6	6	0	0	0	0	1	0	6	1	5	4	0	0
Maximum Detection Limit		NR	NR	NR	NR	NR	NR	5	0.20	0.050	0.005	0.10	0.010	0.050	0.010	0.50	0.0010	0.01	0.050	0.020	0.025
Drinking Water Standards[5]			6.5-8.5 (s)				500(s)			0.050	0.050	2.0	0.005	0.100	1.3	0.3(s)	0.002	0.05(s)	0.05	0.05	5.0(s)
Aquatic Life Standards[6]			6.5-9.0					25-80	10	0.009	0.18(d)-0.34(d)		0.0015(d)-0.006(d)	0.01(d)-0.015(d)	16.1(d)-25.3(d)	1.0	0.000012(d)-0.002		0.0016(d)-0.08(d)	0.005-0.02	0.145(d)-0.160(d)

Source: Newmont, 1999; NAC 445A.144

[1] See Figure 3-2 for location of monitoring sites.

[2] Average values were calculated assuming half detection limit for values below detection limit.

[3] Samples collected generally quarterly; Alk. = Alkalinity; Cond. = Conductivity (field); Hard. = Hardness; TDS = total dissolved solids; TSS = total suspended solids; Turb. = turbidity; Ag = silver; As = arsenic; Ba = barium; Cd = cadmium; Cr = chromium; Cu = Copper; Fe = iron; Hg = mercury; Mn = manganese; Pb = lead; Se = selenium; Zn = zinc; °C = degree celsius; SU = standard pH units (lab measured); mg/l = milligrams per liter; uMHOS/cm = microhoms per cemtimenter; NTU = nephelometric turbidity units; bdl = below detection limits.

[4] Based on strictest standard.

[5] All concentrations reported are primary drinking water standards unless followed by (s) indicating secondary standards.

[6] All standards for metals are for total recoverable, unless noted with (d) for dissolved fraction.

Ag, Cd, Cu, Pb, and Zn concentration standards are calculated based on a hardness of 175 mg/l, representative of Maggie Creek and the Humboldt River.

For As, Cd, Cr, Cu, Hg, Pb, Se, and Zn low values are 96-hour average concentration limits, high values are 1-hour average concentration limits. Both may be exceeded only once every 3 years.

For Ag and Fe single concentration limits must not be exceeded.

TABLE 3-10
WATER TEMPERATURES IN MAGGIE CREEK AND HUMBOLDT RIVER

Monitoring Site	Period of Record	Water Temperature[2] (°C) Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept
MAG-1	1990-1998	NR	NR	10	NR	NR	12	14	13	23	NR	23	17
MAG-2	1990-1996	NR	NR	3	NR	NR	9	11	11	22	NR	NR	26
MAG-3	1990-1998	NR	NR	3	NR	NR	10	8	10	20	18	22	18
MAG-4	1990-1996	NR	NR	3	NR	NR	8	6	9	19	NR	NR	18
HUM-1	1990-1998	NR	NR	3	NR	1	10	10	12	18	21	24	18
HUM-2	1990-1996	NR	NR	4	NR	NR	11	14	15	20	NR	NR	15
HUM-3	1990-1997	NR	NR	3	NR	NR	10	13	16	20	NR	NR	14
HUM-4	1990-1996	NR	NR	7	NR	5	12	17	20	20	NR	NR	19
HUM-5	1990-1998	NR	NR	4	NR	7	11	16	15	19	23	21	17
HUM-6	1991-1996	NR	NR	0.6	NR	19	2	20	7	20	NR	NR	18
HUM-7	1991-1996	NR	NR	10	NR	7	10	12	14	20	22	NR	26
HUM-8	1991-1996	NR	NR	NR	9	6	11	14	15	19	NR	NR	24
Humboldt River At Carlin Tunnels Gage[3]		6-15	2-8	1-6	0.5-2	1-5	4-9	6-15	11-19	15-22	17-24	21-23	9-21

Source: Newmont, 1999c; BLM, 1993.
NR = No Record.

[1] MAG-1 through MAG-4 are located on Maggie Creek; HUM-1 through HUM-8 are located on the Humboldt River; HUM-6 is located where the Carlin Hot Spring discharges into the Humboldt River; see Figure 3-2 for station locations. The four stations on Maggie Creek are within the Class C designation; all stations on the Humboldt River, except HUM-5, are within the Palisade control point designation (Tables 3-11 and 3-12).

[2] Average temperature from instantaneous temperature measurement on 1 or 2 days within the month in degrees Celsius.

[3] Mean daily temperature range for the month from 1982-1991 in degrees Celsius.

Newmont has been discharging water into Maggie Creek under a NDEP permit (NV0022268). The mine discharge has been generally within its permit limitations. Table 2-1a presents a summary of the discharge water quality and the NPDES permit limitations. The discharge should not exceed the permit limitations, or the value in Maggie Creek (three meters upstream of the outfall location), whichever is greater. Average values of total suspended solids (TSS), turbidity, cadmium, iron, mercury, manganese, and selenium are lower or equal in the discharge water than in either the receiving water of Maggie Creek just upstream of the outfall, or the Humboldt River Control point at Palisade. Total dissolved solids (TDS) values are just slightly higher in the discharge waters than in Maggie Creek or the Humboldt River. Arsenic concentrations are higher in the discharge waters than in Maggie Creek or the Humboldt River, however still below the permit limit. Arsenic concentrations increased at the mouth of Maggie Creek (MAG-1) after discharge into Maggie Creek started in 1994, but are still well below the most stringent water quality standard. Arsenic concentrations remained unchanged at the water quality control point at Palisade.

Water Quality Standards

Water quality standards for state waters have been established by the State of Nevada under the Nevada Water Pollution Control statutes NAC 445A.070 et seq.; Nevada Revised Statutes (NRS) 445A.447). Beneficial use categories include drinking water (municipal or domestic supply), irrigation, livestock watering, industrial, recreation (contact and non-contact), propagation of wildlife, and aquatic life. Nevada's water quality criteria and standards for applicable chemical parameters and beneficial use categories are presented in **Tables 3-11** and **3-12.** Water quality standards for the Humboldt River in the project vicinity have been established at the Palisade control point (**Table 3-13**) (NAC 445A.204).

Tributaries of Maggie Creek are designated Class A waters; Maggie Creek from where it is formed by tributaries to its confluence with Jack Creek is designated a Class B water; and Maggie Creek from its confluence with Jack Creek to the Humboldt River is considered Class C water (**Table 3-11**). Standards assigned to the rivers and streams consist of selected nonmetal parameters such as temperature, pH, chloride, nitrate, total dissolved solids, and suspended solids. Water quality standards for metals and other selected parameters in surface water are presented in **Table 3-12**.

Quality of any waters receiving waste discharges must be such that no impairment of beneficial usage occurs as a result of the discharge (NAC 445A.120). Discharge permits are required from the NDEP, Bureau of Water Pollution Control for anyone who intends to discharge to state waters (NAC 445A.228-263).

Spring and Seep Surveys

Numerous springs and seeps have been inventoried by Newmont within a 10-mile radius of the South Operations Area (Newmont, 1999b) (**Figure 3-4**). Information gathered during the field surveys includes geologic occurrence and control, development, vegetation type, water pH, dissolved oxygen content, water temperature, and flow rate. The 74 springs inventoried by Newmont in the study area since fall 1990 are shown in **Figure 3-4**. The spring locations are numbered from 1 to 73 plus MCD 2 (four of the earlier numbered springs have been dropped from the survey because they were redundant with other sampling, or they were in an area no longer of interest, or other reasons). The surveyed springs are not inclusive of all springs and seeps in the study area but were selected to be representative of the various spring types and location. JBR (1992b) conducted a comprehensive spring and seep inventory in May and June 1992 that identified approximately 192 springs and seeps. Some of these sites contain two or more springs, but were identified as only one site. Seeps and springs smaller than 200 square feet were generally not assessed unless part of a larger complex. In addition, a few seeps and springs may not have been found in this effort and were thus not assessed. Additional springs outside the initially surveyed area were identified in surveys conducted for Barrick Goldstrike Mines (BLM, 2000b). The listing of all springs is on file with the BLM. In addition to all the above-mentioned surveys, springs in the Independence Mountains are mapped on USGS quadrangle maps. Springs in the Carlin Trend area have been categorized into several main types based on geologic

TABLE 3-11 (continued)
CLASS A, B & C WATER QUALITY STANDARDS FOR NEVADA

Item	Class A Specifications	Class B Specifications	Class C Specifications
Floating solids or sludge deposits	None attributable to human activities	Only such amounts attributable to human activities which will not make the waters unsafe or unsuitable as a drinking water source, injurious to fish or wildlife or impair the waters for any other beneficial use established for this class.	Only those amounts attributable to the activities of man which will not make the receiving waters injurious to fish or wildlife or impair the waters for any beneficial use established for this class.
Odor-producing substances	None attributable to human activities	Only such amounts which will not impair the palatability of drinking water or fish or have a deleterious effect upon fish, wildlife or any beneficial uses established for waters of this class.	Not specified.
Sewage, industrial wastes or other wastes	None allowed	None which are not effectively treated to the satisfaction of the department.	None which are not effectively treated to the satisfaction of the department.
Toxic materials, oil, deleterious substances, colored or other wastes	None allowed	Only such amounts as will not render the receiving waters injurious to fish or wildlife or impair the receiving waters for any beneficial use established for this class.	Only such amounts as will not render the receiving waters injurious to fish or wildlife or impair the receiving waters for any beneficial use established for this class.
Settleable solids	Only amounts attributable to human activities which will not make the waters unsafe or unsuitable as a drinking water source or which will not be detrimental to aquatic life or for any other beneficial use established for this class.	Only such amounts attributable to human activities which will not make the waters unsafe or unsuitable as a drinking water source, injurious to fish or wildlife or impair the waters for any other beneficial use established for this class.	Only those amounts attributable to the activities of man which will not make the receiving waters injurious to fish or wildlife or impair the waters for any beneficial use established for this class.
pH	Range between 6.5 and 8.5	Range between 6.5 and 8.5	Range between 6.5 and 8.5
Dissolved Oxygen	Must not be less than 6.0 **m**g/L[1].	For trout waters, not less than 6.0 mg/L; for non trout waters, not less than 5.0 mg/L.	For trout waters, not less than 6.0 mg/L; for nontrout waters, not less than 5.0 mg/L.
Temperature	Must not exceed 20° C. Allowable temperature increase above natural receiving water temperature: None	Must not exceed 20° C for trout waters or 24° C for nontrout waters. Allowable temperature increase above natural receiving water temperatures: None	Must not exceed 20° C for trout waters or 34° C for nontrout waters. Allowable temperature increase above natural receiving water temperatures: 3° C
Fecal Coliform	The fecal coliform concentrations, based on a minimum of 5 samples during any 30-day period, must not exceed a geometric mean of 200 per 100 mL, nor may more than 10 percent of total samples during any 30-day period exceed 400 per 100 mL.	The fecal coliform concentrations, based on a minimum of 5 samples during any 30-day period, must not exceed a geometric mean of 200 per 100 mL, nor may more than 10 percent of total samples during any 30-day period exceed 400 per 100 mL.	See NAC 445A.126.

TABLE 3-11 (continued)
CLASS A, B & C WATER QUALITY STANDARDS FOR NEVADA

Item	Class A Specifications	Class B Specifications	Class C Specifications
Total phosphate	Must not exceed 0.15 mg/L in any stream at the point where it enters any reservoir or lake, nor 0.075 mg/L in any reservoir or lake, nor 0.30 mg/L in streams and other flowing waters.	Must not exceed 0.3 mg/L.	Must not exceed 1.0 mg/L.
Total Dissolved Solids	Must not exceed 500 mg/L or one-third above that characteristic of natural conditions (whichever is less).	Must not exceed 500 mg/L or one-third above that characteristic of natural conditions (whichever is less).	Must not exceed 500 mg/L or one-third above that characteristic of natural conditions (whichever is less).

Source: NAC 445A.124-126.
[1] mg/L = milligrams per liter.

TABLE 3-12
WATER QUALITY CRITERIA AND STANDARDS FOR NEVADA

Parameter[1] (mg/L)	Drinking Water Std.		Municipal or Domestic Supply	Aquatic Life[6]		Agriculture		
	Primary	Secondary		1-Hr Average	96-Hr Average	Irrigation	Stock Water	Wildlife Propagation
Antimony	0.006	--	0.146	--	--	--	--	--
Arsenic	0.05	--	0.05	0.34 As(III)	0.18 As(III)	0.1	0.2	--
Barium	2.0	--	2.0	--	--	--	--	--
Beryllium	0.004	--	0	--	--	0.1	--	--
Boron	--	--	--	--	--	0.75	5.0	--
Cadmium[5]	0.005	–	0.005	**0.0062**[3]	**0.0015**[3]	0.01	0.05	--
Chromium	0.1	--	0.10	0.015 Cr(VI)	0.01 Cr(VI)	0.1	1.0	--
Copper[5]	1.3	--	--	**0.0253**[3]	**0.0161**[3]	0.2	0.5	--
Iron	--	0.3[0.6][2]	--	1.0	1.0	5.0	--	--
Lead[5]	0.05	–	0.05	**0.0022**[3]	**0.0016**[3]	5.0	0.1	--
Magnesium	--		125/150	--	--			
Manganese	--	0.05[0.1]	--	--	--	0.2	--	--
Mercury	0.002	–	0.002	0.002	0.000012	--	0.01	--
Molybdenum	--	--	--	0.019	0.019			
Nickel[5]	0.1	--	0.0134	**1.919**[3]	**0.213**[3]	0.2	--	--
Selenium	0.05	--	0.05	0.020	0.005	0.02	0.05	--
Silver[5]	0.05	--	--	0.0089[3]	0.0089[3]	--	--	--
Thallium	0.002	--	0.013	--	--	--	--	--
Zinc[5]	--	5.0	--	**0.159**[3]	**0.144**[3]	2.0	25.0	--
Cyanide (WAD)	--	--	0.2	0.022	0.0052	--	--	--
Alkalinity	--	--	--	less than 25% change		--	--	30-130
Chloride	--	250[400]	250[400]	--	--	--	1,500	1,500
Color (PCU)	--	15	75	--	--	--	--	--

TABLE 3-12 (continued)
WATER QUALITY CRITERIA AND STANDARDS FOR NEVADA

Parameter[1] (mg/L)	Drinking Water Std.		Municipal or Domestic Supply	Aquatic Life[6]		Agriculture		
	Primary	Secondary		1-Hr Average	96-Hr Average	Irrigation	Stock Water	Wildlife Propagation
Dissolved Oxygen	--	--	Aerobic	5.0	5.0	--	Aerobic	Aerobic
Fluoride	4.0	2.0	--	--	--	1.0	2.0	--
Nitrate as N	10	--	10	90(w)	90(w)	--	100	100
pH (SU)	--	6.5-8.5	5.0-9.0	6.5-9.0	6.5-9.0	4.5-9.0	5.0-9.0	7.0-9.2
Sulfate	--	250[500]	250[500]	--	--	--	--	--
Temperature °C	--	--	--	Site specific determination		--	--	--
TDS	--	500[1,000]	500[1,000]	--	--	--	3,000-7,000	--
TSS	--	--	--	25-80	25-80	--	--	--
Turbidity (NTU)	--	--	--	50(w);10(c)	50(w);10(c)	--	--	--

Source: NAC 445.11**9**; NAC 445**A**.**144**.

1 mg/L = milligrams per liter; PCU = photoelectric color units; SU = standard units; NTU = nephelometric turbidity units; TDS = total dissolved solids; TSS = total suspended solids; °C = degrees Celsius.

2 Numbers in brackets [ ] are mandatory secondary standards for public water systems.

3 Parameter dependent on hardness; a hardness value of 175 **m**g/l was used to calculate the criteria for hardness-dependent metals in Maggie Creek and the Humboldt River.

4 (w) refers to warm water and (c) is for cold water. No letter designation indicates criteria are common to both warm and cold water.

5 Dissolved Fraction only.

6 Aquatic life standards are presented in mg/L rather than g/L.

TABLE 3-13
WATER QUALITY STANDARDS FOR HUMBOLDT RIVER AT PALISADE GAGE CONTROL POINT

Parameter[1] (mg/L)	Water Quality Standards for Beneficial Uses[2]	Most Restrictive Beneficial Use
Temp - °C	2°C [3] **(single value)**	Aquatic life (warm water fishery)
pH - SU	6.5 - 9.0 ± 0.5 (single value)	Water contact recreation; wildlife propagation
Dissolved Oxygen	5.0 (single value)	Aquatic life (warm water fishery)
Chlorides	250 (single value)	Municipal or domestic supply
Total Phosphorus (as P)	0.1 (Apr- Nov season average)	Aquatic Life (warm water fishery)
Nitrogen species	**≤ 10 (nitrate single value)** **≤ 1.0 (nitrite single value)** **≤ 0.02 (ammonia single value)**	Municipal or domestic supply
TDS	500 (annual average)	Municipal or domestic supply
TSS	80 (annual median)	Aquatic life (warm water fishery)
Color - PCU	No **adverse** effects	Municipal or domestic supply
Turbidity - NTU	50 (single Value)	Aquatic life (warm water fishery)

Source: NAC 445A.204.

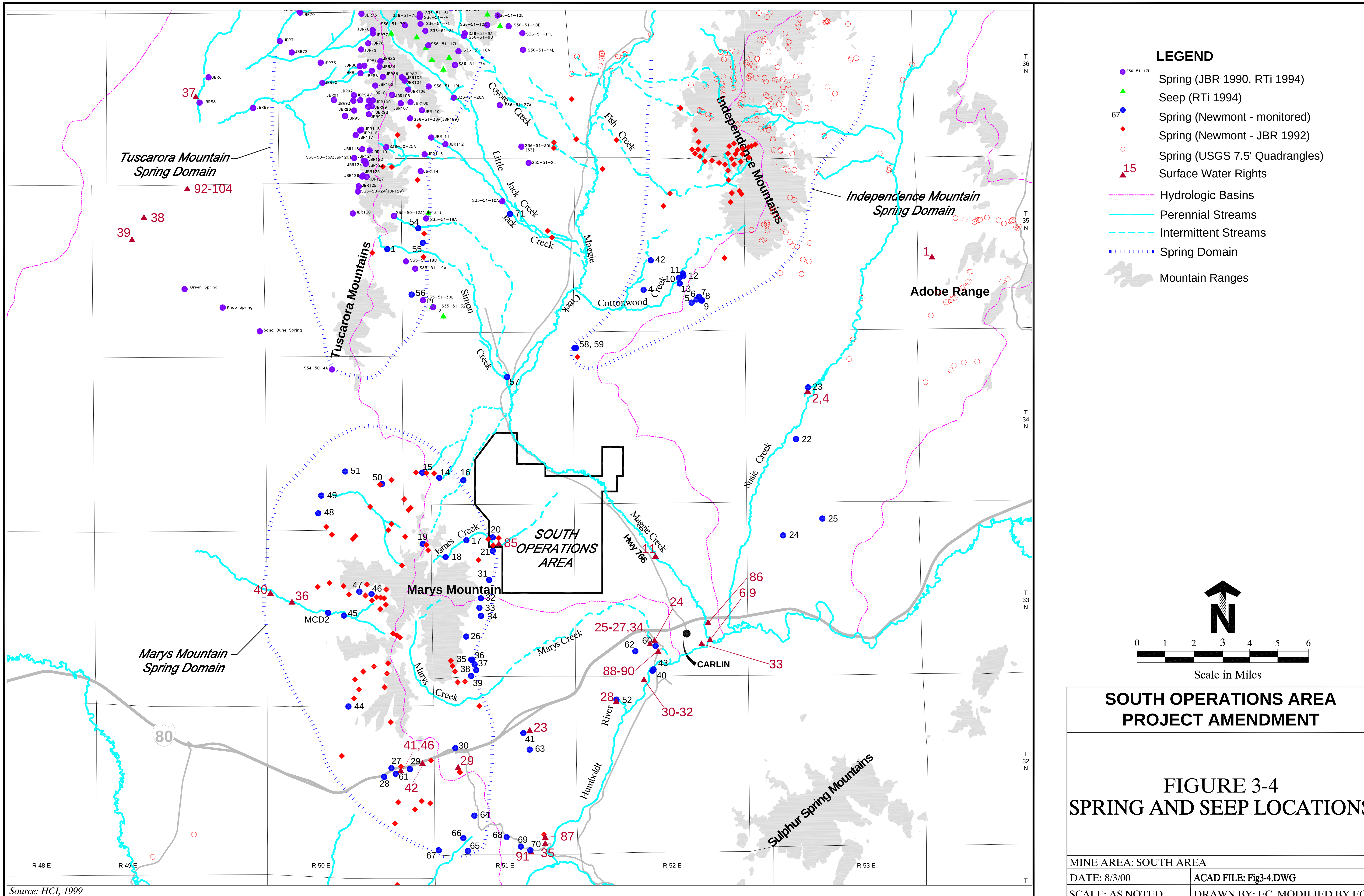
[1] mg/L = milligrams per liter; °C = degrees Celsius; SU = standard pH units; TDS = total dissolved solids; TSS = total suspended solids; PCU = photoelectric color units; NTU = nephelometric turbidity units. Limits apply from the control point at Palisade gage upstream to the Elko control point.

[2] = change; all values are single value measurements, except nitrates and TDS, which are annual averages.

[3] Maximum allowable increase in temperature at the boundary of an approved mixing zone.

control (Stone and Leeds, 1991; Balleau Groundwater Consulting, 1992). Discharge of water can occur at the contact of permeable and impermeable materials such as at faults, dikes, or other barriers. Some springs and seeps represent exposure of the water table in a depression or topographic low. Water can also be stored and released from localized areas of unconsolidated material such as colluvium. Water can be at artesian pressure (confined or semi-confined condition) or at atmospheric pressure (unconfined condition). Springs can be associated with extensive groundwater flow systems or they can be perched or "bounded" where the source is a relatively small, localized groundwater system separated from regional groundwater. Most springs and seeps in the project area are located at and above the base of mountains and far above the elevation of regional groundwater in adjacent valleys. According to Balleau Groundwater Consulting (1992), springs above an elevation of about 6,000 feet are typically isolated from the regional groundwater flow system.

Within a 10-mile radial distance of the Gold Quarry Mine, the majority of inventoried springs and seeps have flow rates of less than 5 gallons per minute (gpm). Of the 74 springs measured by Newmont, 15 springs (Newmont No. 14, 15, 16, 17, 18, 24, 27, 28, 42, 49, 50, 62, 66, 69, and 70) had average October Flows between 5 and 50 gpm, only 5 springs (Newmont No. 21, 52, 57, 71, and MCD 2) had average October flows greater an 50 gpm (Newmont, 1999b). Seasonal variations in flow occur in a number of springs, indicating



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-4
SPRING AND SEEP LOCATIONS

MINE AREA: SOUTH AREA
DATE: 8/3/00 | ACAD FILE: Fig3-4.DWG
SCALE: AS NOTED | DRAWN BY: EC, MODIFIED BY EG

shallow perched systems where flow is quickly influenced by seasonal variations in precipitation. Data from BLM files for 1982 field studies also show that the majority of springs observed in the South Operations Area were flowing at rates of less than 5 gpm.

Springs are generally classified as either thermal or non-thermal based on temperature and chemical characteristics. Thermal springs generally have higher trace metal and major ion concentrations than non-thermal springs.

Temperatures for springs of a non-thermal origin range from approximately 3° to 26°C, whereas those of thermal springs typically range from 55 to 68°C. For springs inventoried in the Maggie, Marys, and Susie Creeks Hydrographic Basins, three hot springs and one warm spring have been identified (Newmont No. 24, 40, 43, and 52). Spring 24 is located in the Susie Creek Hydrographic Basin, springs 40 and 43 are located along the Humboldt River in Marys Creek Hydrographic Basin, Spring 52 is also in Marys Creek Hydrographic Basin. Spring 52 **has** average temperatures around 20°C and flows above 500 gpm. Spring 43 is also known as Carlin Hot Springs, and flows directly into the Humboldt River. Spring 40 is a small spring with October flow rates less than 1 gpm. Spring 24 is a series of small springs with combined flow rates of around 25 gpm. It should be noted that Spring 1 is anomalous with respect to other springs, thermal or non-thermal with elevated concentrations of major ions and trace metals. Maximum measurements at Spring 1 exceed the drinking water standards for arsenic, cadmium, chromium, iron, manganese, and lead, while minimum values **for arsenic, cadmium, chromium, iron, and lead** were well below drinking water standards.

Maximum values of cadmium, chromium, iron and manganese levels were also exceeded in water from Spring 43 (**Table 3-14**). Spring 1 is located near the Carlin Mine in the Tuscarora Mountain Block in the Simon Creek Drainage. Nine of the surveyed sites (springs 1, 18, 21, 34, 43, 44, 50, 52, and MCD 2) were designated for water quality sampling. They included:

1. Springs that were relatively close to mining activity (1, 18, and 21);

2. Springs with significant flow (1, 18, 21**, 43, 52, and MCD 2**);

3. Springs that supported riparian areas (1, 18, 21, 34, 52, and MCD 2); and

4. Springs (such as thermal springs) that were believed to be fed by deep groundwater sources **(43 and 52)**.

A summary of the spring water quality is presented in **Table 3-14**. In addition, as required by the Mitigation Plan (BLM, 1993), eight springs are monitored quarterly for field parameters (flow, temperature, pH, electrical conductivity, and dissolved oxygen) to establish baseline conditions. These include springs 2, 3, 14, 16, 21, 31, 34, and 57. Available data on springs and seeps in the study area can be found in the Spring Survey Gold Quarry, Fall 1998 (Newmont, 1999b). To date, no springs have been affected by dewatering from the Gold Quarry mine.

In the vicinity of the town of Carlin, two major spring complexes discharge from bedrock material and flow into the Humboldt River. The one known as Carlin Hot Spring (#43) discharges adjacent to the Humboldt River at an estimated rate of between 1 and 2 cfs and a temperature as high as 79°C (174°F) (BLM, 1993). This spring is submerged under

TABLE 3-14

SUMMARY OF WATER QUALITY FOR SELECTED SPRINGS IN THE SOAPA STUDY AREA

Spring Site [1] (Period of Record)	Total Concentration Statistics[2,3]	Temp °C	pH SU	Alk mg/l	Cond uMHOS/cm	Hard mg/l	TDS mg/l	TSS mg/l	Turb NTU	Ag mg/l	As mg/l	Ba mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Fe mg/l	Hg mg/l	Mn mg/l	Pb mg/l	Se mg/l	Zn mg/l
Spring - 1 (1991-1998)	No. of Samples	10	10	6	9	3	9	10	8	2	10	2	5	10	10	10	5	10	10	10	10
	Minimum	3.0	7.49	132.00	1675.00	1210	1100	3.6	0.30	0.005	0.011	bdl	bdl	bdl	bdl	bdl	bdl	0.06	bdl	bdl	bdl
	Average	11.4	7.93	160.00	2890.56	1556	2441	43.9	12.71	0.008	0.037	0.07	0.013	0.015	0.008	0.33	0.0006	0.16	0.025	0.006	0.038
	Maximum	17.7	8.64	234.00	5100.00	1749	3620	276.0	65.00	0.011	0.158	0.09	0.020	0.016	0.030	1.48	0.0009	0.45	0.170	0.012	0.143
	No. above Detection Limit	10	10	6	9	3	9	10	8	2	10	1	4	1	2	9	3	10	2	7	8
	No. above Water Standard[4]	0	0	0	0	0	9	4	2	1	2	0	4	1	0	2	3	10	2	6	0
Spring - 18 (1990-1996)	No. of Samples	12	12	8	12	3	11	12	11	4	12	4	6	12	12	12	6	12	12	12	12
	Minimum	3.4	7.50	59.60	113.00	76	85	bdl	0.20	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.02	bdl	bdl	bdl
	Average	10.8	8.03	140.83	310.56	170	231	8.7	5.64	bdl	0.003	0.07	bdl	bdl	0.005	0.54	bdl	0.05	bdl	0.002	0.010
	Maximum	17.6	8.49	217.00	560.00	250	361	26.0	18.00	bdl	0.009	0.08	bdl	0.008	0.020	2.96	bdl	0.14	bdl	0.002	0.030
	No. above Detection Limit	12	12	8	12	4	11	9	11	0	2	3	0	2	1	11	0	12	0	1	6
	No. above Water Standard[4]	0	0	0	0	0	0	1	1	0	0	0	0	0	0	5	0	5	0	0	0
Spring - 21 (1991-1998)	No. of Samples	13	13	8	13	4	12	13	12	3	13	3	6	13	13	13	6	13	12	13	13
	Minimum	7.0	7.93	121.00	128.00	250	120	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	Average	12.0	8.19	208.38	370.38	255	272	18.4	4.01	bdl	0.002	0.09	0.004	bdl	0.006	0.23	0.0003	0.02	0.014	0.003	0.018
	Maximum	19.6	8.62	241.00	541.00	259	344	51.8	8.90	bdl	0.006	0.12	0.006	0.003	0.032	0.62	0.0005	0.05	0.080	0.005	0.120
	No. above Detection Limit	13	13	8	13	4	12	12	10	0	1	2	1	1	1	12	1	10	5	2	8
	No. above Water Standard[4]	0	0	0	0	0	0	3	0	0	0	0	1	0	0	4	1	2	5	1	0
Spring - 34 (1991-1998)	No. of Samples	13	13	8	13	4	12	13	12	3	13	3	6	13	13	13	6	13	13	13	13
	Minimum	6.5	7.30	226.00	133.00	263	242	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	Average	13.3	7.90	254.13	524.92	307	363	44.1	9.63	bdl	0.003	0.08	0.004	bdl	0.013	0.98	0.0003	0.22	0.012	bdl	0.068
	Maximum	26.0	8.47	281.00	827.00	332	464	240.0	45.00	bdl	0.008	0.13	0.006	bdl	0.120	4.80	0.0005	1.20	0.080	0.001	0.320
	No. above Detection Limit	13	13	8	13	4	12	12	11	0	3	2	1	0	3	12	1	11	4	1	11
	No. above Water Standard[4]	0	0	0	0	0	0	4	4	0	0	0	1	0	0	5	1	7	4	0	1
Spring - 43 (1991-1996)	No. of Samples	19	20	16	19	12	19	20	19	11	20	11	13	20	20	20	14	20	20	20	20
	Minimum	17.0	6.75	135.00	300.00	121	280	bdl	bdl	bdl	bdl	0.11	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	Average	53.9	7.82	243.06	758.95	175	392	36.6	7.60	bdl	0.011	0.24	0.004	0.015	0.007	0.55	0.0002	0.09	0.008	bdl	0.016
	Maximum	79.0	8.28	312.00	1200.00	195	452	166.0	42.00	bdl	0.021	0.34	0.007	0.130	0.050	2.80	0.0003	0.53	0.020	bdl	0.072
	No. above Detection Limit	19	19	16	19	12	19	16	18	0	19	11	3	2	6	19	3	17	3	0	11
	No. above Water Standard[4]	0	0	0	0	0	0	7	3	0	0	0	3	1	0	8	3	10	3	0	0
Spring - 44 (1992-1996)	No. of Samples	9	9	5	9	1	8	9	8	1	9	1	3	9	9	9	3	9	9	8	9
	Minimum	3.8	7.00	70.50	153.00	247	311	bdl	1.00	bdl	bdl	0.06	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	Average	14.0	7.75	83.92	736.89	247	543	2537.2	445.90	bdl	0.008	0.06	bdl	bdl	0.004	0.49	bdl	0.38	0.009	bdl	0.015
	Maximum	26.4	8.60	126.00	1435.00	247	860	22330.0[7]	3540.00[7]	bdl	0.050	0.06	bdl	0.003	0.010	1.46	bdl	1.62	0.011	bdl	0.085
	No. above Detection Limit	9	9	5	9	1	8	8	8	0	3	1	0	1	1	8	0	8	2	0	4
	No. above Water Standard[4]	0	1	0	0	0	5	5	2	0	1	0	0	0	0	5	0	6	2	0	0
Spring - 50 (1991-1996)	No. of Samples	11	10	11	5	3	9	10	9	2	11	2	5	11	11	11	5	11	11	11	11
	Minimum	9.1	8.00	122.00	141.00	235	12	bdl	0.30	bdl	bdl	0.08	bdl	bdl	bdl	0.03	bdl	bdl	bdl	bdl	bdl
	Average	13.0	8.22	490.00	170.20	269	319	22.6	4.76	bdl	0.002	0.09	bdl	bdl	0.004	0.18	0.0003	0.04	0.006	0.003	0.047
	Maximum	20.8	8.37	654.00	189.00	291	454	71.6	15.20	bdl	0.007	0.09	bdl	0.005	0.008	0.46	0.0005	0.14	0.002	0.007	0.390
	No. above Detection Limit	11	10	11	5	3	9	9	9	0	2	2	0	1	1	11	1	10	2	5	7
	No. above Water Standard[4]	0	0	0	0	0	0	3	2	0	0	0	0	0	0	2	1	3	2	3	1
Spring - 52 (1992-1996)	No. of Samples	8	9	4	8	1	8	9	8	1	9	1	4	9	9	8	3	9	9	9	9
	Minimum	20.2	7.70	140.00	376.00	150	233	bdl	bdl	bdl	0.005	0.10	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	Average	21.3	8.09	144.25	413.50	150	281	1.8	0.26	bdl	0.008	0.10	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.002	bdl
	Maximum	23.0	8.40	149.00	457.00	150	320	2.5	0.80	bdl	0.011	0.10	bdl	0.005	bdl	bdl	bdl	bdl	bdl	0.003	bdl
	No. above Detection Limit	8	9	4	8	1	8	3	3	0	9	1	0	1	0	0	0	0	0	2	0
	No. above Water Standard[4]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 3-14
SUMMARY OF WATER QUALITY FOR SELECTED SPRINGS IN THE SOAPA STUDY AREA

Spring Site [1] (Period of Record)	Total Concentration Statistics[2,3]	Temp °C	pH SU	Alk mg/l	Cond uMHOS/cm	Hard mg/l	TDS mg/l	TSS mg/l	Turb NTU	Ag mg/l	As mg/l	Ba mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Fe mg/l	Hg mg/l	Mn mg/l	Pb mg/l	Se mg/l	Zn mg/l
MCD - 2 (1991-1996)	No. of Samples	10	10	8	10	3	10	11	10	2	11	2	5	11	11	11	5	11	11	11	11
	Minimum	5.3	7.60	85	92.00	135	109	bdl	bdl	bdl	bdl	0.07	bdl	bdl	bdl	0.12	bdl	0.02	bdl	bdl	0.011
	Average	12.9	7.99	123.75	319.60	162	242	21.4	2.50	bdl	0.002	0.08	bdl	bdl	bdl	0.47	0.0004	0.06	0.006	0.003	0.067
	Maximum	21.2	8.20	170	509.00	190	361	100.0	9.00	bdl	0.006	0.08	bdl	bdl	bdl	0.96	0.0006	0.13	0.005	0.006	0.160
	No. above Detection Limit	10	10	8	10	3	10	10	9	0	3	2	0	0	0	11	1	11	1	2	11
	No. above Water Standard[4]	0	0	0	0	0	0	2	0	0	0	0	0	0	0	6	1	7	1	2	1
Maximum Detection Limit		NR	NR	NR	NR	NR	NR	5	0.50	0.005	0.020	0.10	0.010	0.100	0.010	0.05	0.0010	0.05	0.050	0.010	0.020
Drinking Water Standards[5]			6.5-8.5 (s)				500(s)			0.050	0.050	2.0	0.005	0.100	1.3	0.3(s)	0.002	0.05(s)	0.05	0.05	5.0(s)
Aquatic Life Standards[6]			6.5-9.0					25-80	10	0.009(d)	0.18(d)-0.34(d)		0.0015(d)-0.006(d)	0.01(d)-0.015(d)	16.1(d)-25.3(d)	1.0	0.000012(d)-0.002		0.0016(d)-0.08(d)	0.005-0.02	0.145(d)-0.160(d)

Source: Newmont, 1999; NAC 445A.144

[1] See Figure 3-3 for location of springs.

[2] Average values were calculated assuming half detection limit for values below detection limit.

[3] Samples collected generally semi-annually through May 1998 after which chemistry analysis was ended. Results are for unfiltered samples only; Alk. = Alkalinity; Cond. = Conductivity (field); Hard. = Hardness; TDS = total dissolved solids; TSS = total suspended solids; Turb. = turbidity; Ag = silver; As = arsenic; Ba = barium; Cd = cadmium; Cr = chromium; Cu = Copper; Fe = iron; Hg = mercury; Mn = manganese; Pb = lead; Se = selenium; Zn = zinc; °C = degree celsius; SU = standard pH units (lab measured); mg/l = milligrams per liter; uMHOS/cm = microhoms per cemtimenter; NTU = nephelometric turbidity units; bdl = below detection limits.

[4] Based on strictest standard.

[5] All concentrations reported are primary drinking water standards unless followed by (s) indicating secondary standards.

[6] All standards for metals are for total recoverable, unless noted with (d) for dissolved fraction.

Ag, Cd, Cu, Pb, and Zn concentration standards are calculated based on a hardness of 175 mg/l, representative of Maggie Creek and the Humboldt River.

For As, Cd, Cr, Cu, Hg, Pb, Se, and Zn low values are 96-hour average concentration limits, high values are 1-hour average concentration limits. Both may be exceeded only once every 3 years.

For Ag and Fe single concentration limits must not be exceeded.

[7] Single high values (Spring -44) may be caused by sediment disturbed during the sampling process.

the Humboldt River except during low-flow conditions. The second major spring near the town of Carlin, known as the Carlin "Cold" Spring complex (#60), discharges in the Marys Creek drainage near its confluence with the Humboldt River. This group of springs flows at an average rate of about 2.8 cfs. An average rate of about 1.0 cfs is diverted from this spring for municipal use at Carlin (BLM, 1993). These two spring sites are shown in **Figure 3-4**.

Surface Water Use

A listing of surface water rights was obtained from a database from the **NDCNR**, Division of Water Resources, to provide information on location and status of water rights within four Hydrographic Basins (Maggie Creek, Marys Creek, Susie Creek, and Boulder Flat). A total of 80 surface water rights (including water rights owned by the two major mining companies, Barrick Goldstrike Mines, and Newmont Mining Corporation, and their subsidiaries) have active status in the four basin area. This includes surface water rights for which certificates, permits, and vested water rights have been awarded. An additional five water rights have been applied for. The primary uses for the water are stock watering and irrigation. A total of 23 surface water rights are in or near the hydrology study area and are shown in **Figure 3-4**. A listing of the surface water rights is available for inspection at the Nevada Division of Water Resources.

Pursuant to the Humboldt River adjudication, all surface water has been fully appropriated. The original allocation of water rights in the Humboldt River system depended on substantial contribution of return flows from irrigated lands. Currently, water is appropriated according to rate and volume. Water rights for irrigation below Palisade were awarded only for the period March 15 through September 15; water rights for irrigation above Palisade were for the period April 15 to August 15.

Groundwater Hydrology

The study area for groundwater (excluding the cumulative study area for other mines) is that portion of the Carlin Trend north of the Humboldt River in the Susie, Maggie, Marys Creeks, and Boulder Flat basins. Recharge, flow, and discharge of groundwater in the South Operations Area are influenced primarily by geologic conditions. In the South Operations Area, sedimentary deposits have primary porosity and permeability surrounding individual grains; subsequent earth movements produced secondary permeability via faults and fractures. Alteration associated with mineralization has further influenced these conditions. Subsurface geologic structures and solution cavities may act as hydraulic conduits for increased groundwater flow or as barriers to groundwater movement. Geologic structures in the study area that influence groundwater movement include the Roberts Mountain thrust fault and a number of basin-bounding, high-angle normal faults and fault zones, some with displacements of several thousand feet (Stone and Leeds, 1991).

Groundwater recharge in the project area occurs primarily through fractured bedrock in the mountains and through unconsolidated alluvium in the valleys. An annual recharge rate of 0.6 inches has been estimated for the project area (Plume and Stone, 1992). Some stream reaches also lose flow and thus recharge the shallow groundwater system.

Groundwater leaves the basin as evapotranspiration and **via** the Humboldt River. Different authors estimate various groundwater flows into the Humboldt River between Carlin Tunnels and Palisade. Plume (1994) indicates an average of 51 cfs; Maurer et al. (1996) use 10 to 20 cfs. RTi (1999) shows an average of 51 cfs for the period from 1946 to 1990.

Six hydrostratigraphic units are recognized in the South Operations Area (**Table 3-15**): **(1)** the shallowest unit is younger basin-fill alluvium (Quaternary age). Below the alluvium are the following hydrostratigraphic units in descending order; (**2**) older basin-fill sediments known as the Carlin Formation (Tertiary age); (**3**) volcanic rocks (Tertiary age); (**4**) intrusive rocks (Tertiary through Jurassic age); (**5**) siltstone (Paleozoic age); and (**6**) carbonate rocks (Paleozoic age). Underlying these six units is Eureka Quartzite (Paleozoic age) and the Pogonip Group formations with low permeability that restricts groundwater movement. In the South Operations Area, the siltstones are structurally separated from the carbonates by thrust faults and/or normal faults.

Groundwater flow in the six hydrostratigraphic units can be generalized as three primary flow systems: (1) perched system in all units associated primarily with mountainous areas; (2) upper unconfined or water table system primarily in basin-fill sediments, siltstones, and volcanics; and (3) lower semi-confined carbonate rock system. Perched groundwater occurs where groundwater moves separately in shallow sediments and bedrock fractures, usually discharging as springs at elevations higher than the regional groundwater systems. Groundwater in the upper unconfined system generally flows within each separate drainage basin toward the basin axes and ultimately to discharge areas along the Humboldt River. In the Maggie Creek Basin Region, the groundwater generally flows to the southeast at a gradient of one percent. Flow in the deeper system in the lower semi-confined carbonate unit is not limited to a single hydrologic basin. A single extensive groundwater flow system exists, where groundwater divides typically do not coincide with topographic divides (HCI, 1999). Within the carbonate unit are local geothermal systems expressed by elevated water temperatures at various wells and hot springs. The carbonate unit is also characterized as karstic in some areas. **Table 3-16** summarizes results of aquifer tests conducted at the project area. Well locations are shown in **Figures 3-5 and 3-6**.

Alluvium. The alluvial sediments, developed along area drainages, are generally saturated. This unconsolidated unit is composed of a mixture of clays, silts, sands, and gravels and the thickness ranges from 10 up to 1,600 feet (Maurer et al., 1996). The alluvium is recharged by precipitation and snowmelt, by stream flow losses, and by discharge from the bedrock groundwater system. The surface and groundwater systems are interdependent, with groundwater contributing to stream baseflows (gaining stream) in some areas, and streams contributing to groundwater recharge (losing streams) in other areas. Seasonal variations in this interrelationship are common. Permeability of these unconsolidated sediments is highly variable.

TABLE 3-15
MAJOR HYDROSTRATIGRAPHIC UNITS IN SOAPA STUDY AREA

Hydrostratigraphic Unit	Geologic Age	Stratigraphic Unit	Unit Description
Younger basin-fill deposits	Quaternary	Alluvium	Sorted to poorly sorted deposits of stream flood plains.
Older basin-fill deposits	Tertiary	Carlin Formation	Volcaniclastic sedimentary rocks and deposits of fluvial and lacustrine origin.
Volcanic rocks	Tertiary	Volcanic Intrusives	Rhyolite and basalt flows.
Intrusive Rocks	Tertiary to Jurassic	NA	Graodiorite, quartz monzonite, diorite, monzonite.
Siltstones and shales	Devonian to Ordovician	Rodeo Creek Unit and Vinini Formation	Classic sedimentary rocks.
Carbonate rocks	Devonian to Ordovician	Roberts Mountain and Hanson Creek Formations	Carbonate and minor classic sedimentary rocks.

Source: Plume and Stone, 1992.

TABLE 3-16
SUMMARY OF AQUIFER PUMPING TESTS CONDUCTED AT THE SOAPA STUDY AREA

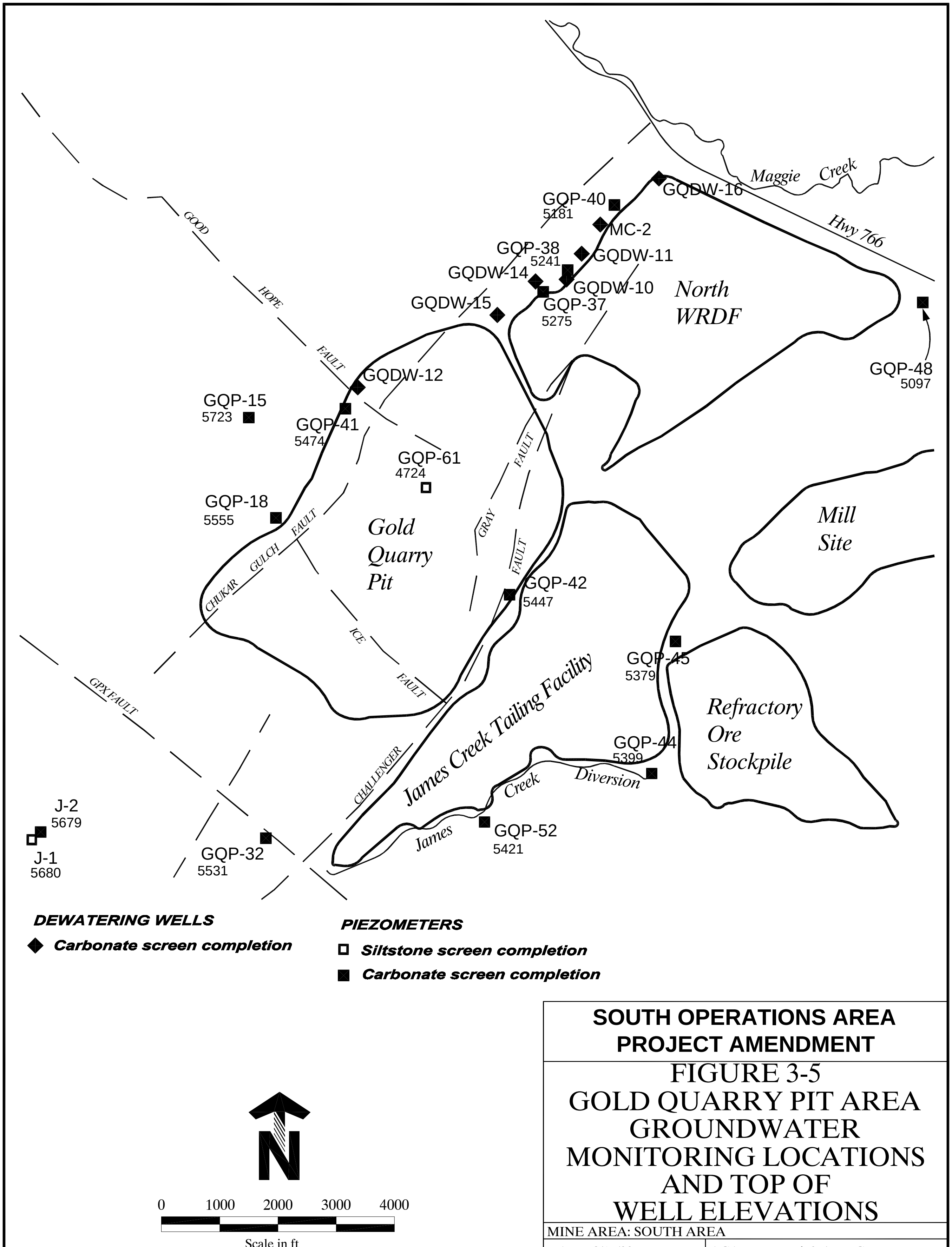
Well No.	Hydrostratigraphic Unit	Well Depth (feet)	Pumping Rate (gpm)[1]	Pumping Period (hours)	Transmissivity (ft^2/day)[2]	Comments[3]
GQTW-1	Roberts Mtn Limestone	997	750	97	7,700	Gold Quarry fault zone; S = $6x10^{-3}$; K = 20 ft/day
GQTW-2	Vinini Siltstone	577	273	102	600	Unaltered siltstone; S = $9x10^{-4}$; K = 2 ft/day
GQTW-3	Paleozoic Siltstone	945	2,800	240	60,000	S = $5x10^{-3}$
GQTW-4	Paleozoic Siltstone	755	5,300	240	60,000	S = $3x10^{-3}$
GQTW-5	Paleozoic Siltstone	820	275	240	6,700	Good Hope fault zone; S = $1x10^{-3}$
GQTW-6	Roberts Mtn Limestone	1620	1400	160	70,000	S = $5x10^{-3}$; K = 23 ft/day
CBN-1	Roberts Mtn Limestone	500	480	5	>53,000	Air lift test; minimal drawdown
MC-2	Roberts Mtn Limestone	1,201	4,000	41	145,000	Fractured Gold Quarry fault zone
PW-9	Roberts Mtn Limestone	710	2,200	24	25,000	Located near well MC-2
52	Carbonate Rock	1,208	4,000	39	300,000	Fault Zone at base of Schroeder Mountain; K = 400 ft/day
29-WW	Carlin Formation	405	220	51	1,100	S = $1x10^{-2}$; K = 1 ft/day
13a	Carlin Formation	724	1,200		870	S = $1.1x10^{-3}$; K = 2.1 ft/day
13a	Carlin Formation	724	631	10	780	K = 1.9 ft/day
13a	Carlin Formation	724	631	10	1,100-3,000	S = $1.9x10^{-3}$; K = 2.7 – 7.3 ft/day
41	Carlin Formation	755	342	24	2,500-3,600	S = $1.9x10^{-3}$; K = 4.3 – 6.3 ft/day
43	Carlin Formation	1,000	338	24	1,500	

Source: Golder Associates, Inc., 1990; BLM, 1993; Plume, 1994.

1 gpm = gallons per minute. During some aquifer tests, various pumping rates were used; the average pumping rate is presented in the table. All tests are pump tests except as noted.

2 ft^2/day = square feet per day. In some cases, several values for transmissivity (T) were determined using various observation wells and calculation methods; an approximate average value for T is presented in the table.

3 S = storativity or storage coefficient; K = hydraulic conductivity (horizontal). In some cases, several values for storativity were determined; an approximate average value for S is presented in the table.



Source: Newmont, 1999c

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-5
GOLD QUARRY PIT AREA GROUNDWATER MONITORING LOCATIONS AND TOP OF WELL ELEVATIONS

MINE AREA: SOUTH AREA	
DATE: 8/17/00	ACAD FILE: Fig3-5.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

Tertiary Sediments. Basin-fill sediments of Tertiary age are referred to as the Carlin Formation. Lithology of this unit is variable and includes siltstone, sandstone, welded tuff, mudstone, shale, conglomerate, and limestone. Thickness of these sediments ranges from a few hundred feet to more than 5,000 feet. Depth to water ranges from 25 to over 300 feet below ground surface. Permeability of these materials generally is low to moderate in this area. A thick basal layer of clay is pervasive in the Carlin Formation.

Tertiary Volcanics. The Tertiary volcanic rocks consist of rhyolite and basalt flows. Thickness of the volcanics reaches over 300 feet in the project area. Numerous fractures have made the volcanic unit very permeable.

Three wells in the Maggie Creek Basin reportedly are completed in the volcanics. Depth to water in these wells ranges from 36 to 66 feet. The Carlin Spring probably issues from a contact between the highly permeable volcanics and a less permeable sedimentary unit (Stone and Leeds, 1991).

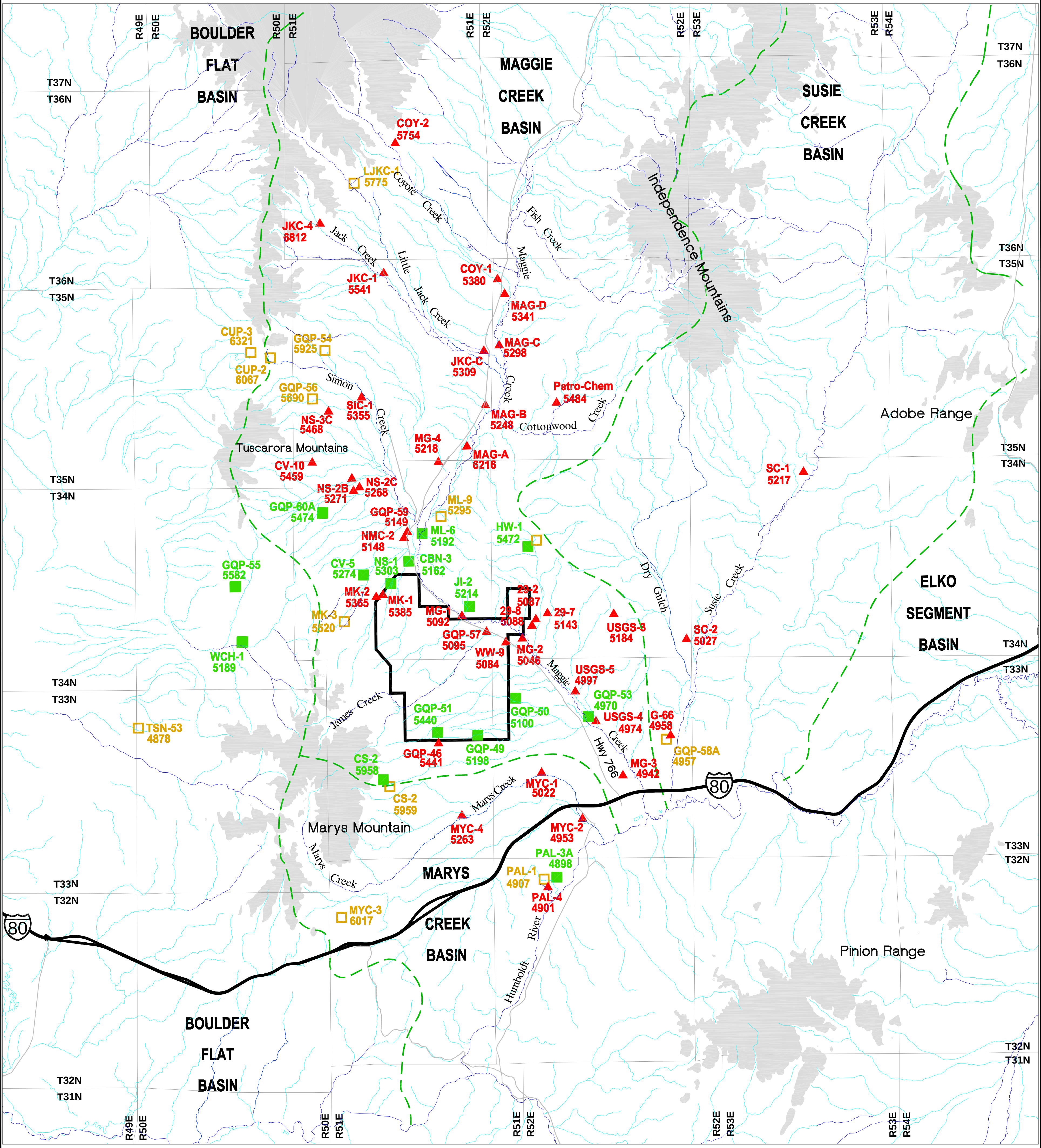
Intrusive Rocks. Tertiary through Jurassic intrusive rocks are a minor component of rock types in the study area and consist mostly of granodiorite, quartz monzonite, monzonite, and diorite. These rocks have relatively low hydraulic conductivity, however, wells completed in the intrusive rocks near faults may yield small quantities of water (Maurer et al., 1996).

Siltstone. Siltstone strata of Paleozoic age lies below the Tertiary deposits and has been faulted out of sequence by the Roberts Mountain thrust. This unit is assigned to the Vinini Formation and consists primarily of fine-grained classic material with thicknesses up to several thousand feet. Groundwater is generally unconfined in this unit; however, some wells have encountered artesian or confined conditions (Stone and Leeds, 1991). Depth to water ranges from less than 100 feet to 300 feet or more. Where the siltstone is silicified and brittle, fractures have developed and provide considerable secondary permeability. The siltstone unit is exposed in most of the mountainous areas, and therefore receives recharge from precipitation and snowmelt.

Carbonates. Approximately 3,000 feet of carbonate rock (limestone) is situated between the overlying siltstone aquifer and the underlying Eureka Quartzite confining unit that forms the effective bottom of the local groundwater flow system. Groundwater in the carbonate strata is predominantly semi-confined or confined. Depth to groundwater in wells in carbonate rock ranges from flowing artesian conditions to over 500 feet. Prior to dewatering, groundwater flow in this unit was generally to the southwest, whereas groundwater moves primarily to the southeast in the four overlying hydrostratigraphic units. High permeability is common in the carbonate rock due to fractures, faulting and localized karst conditions. The carbonate and overlying siltstone units are the primary units that are intercepted and dewatered by the Gold Quarry pit.

Groundwater Quantity

Groundwater levels are measured periodically by Newmont and the USGS in numerous wells in the vicinity of the Gold Quarry Mine (**Figures 3-5 and 3-6**). Depth to groundwater varies widely in the study area depending on the location and hydrostratigraphic unit intercepted. Some wells flow naturally at



Source: Newmont, 1999c

LEGEND

- SOAPA Boundary
- Alluvium/Colluvium/Volcanics (Tertiary)/Carlin (Tertiary) screen completion
- Siltstone screen completion
- Carbonate screen completion

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-6
GROUNDWATER MONITORING LOCATIONS AND TOP OF WELL ELEVATIONS

MINE AREA: SOUTH AREA	
DATE: 8/18/00	ACAD FILE: Fig3-6.DWG
SCALE: AS NOTED	DRAWN BY: ML, MODIFIED BY DS

ground surface, referred to as flowing artesian wells. Seasonal variations in the water table have been observed in regional wells from a range of less than 1 foot to a maximum of approximately 20 feet in the colluvium near the Tuscarora Mountain Block. Seasonal variations in the water table along Maggie Creek average about 3 feet (Newmont, 1999b).

Water level declines of up to 600 feet in the siltstone and carbonate aquifers have been observed since 1992 near the Gold Quarry pit as a result of groundwater pumping (Newmont, 1999c). (The change from pre-mining groundwater elevation in May 1992 is illustrated in **Figure 3-7**). Recent water table elevation contours (December 1998) in the South Operations Area are shown in **Figure 3-8**.

The groundwater levels for selected wells are shown in **Table 3-17** and locations are shown in **Figure 3-6**. Some of the wells have not been noticeably affected by the mine pumping, and maximum and minimum water levels span a range of less than 12 feet (MYC-2, SIC-1, NMC-2, MYC-1, LJKC-1).

The total water production of the Gold Quarry pit increased from 22,470 acre-feet per year in 1994 to 27,910 acre-feet per year in 1997 and fell to 26,850 acre-feet per year in 1998 (**Table 3-18**). All pumping occurred in perimeter carbonate wells in Chukar Gulch.

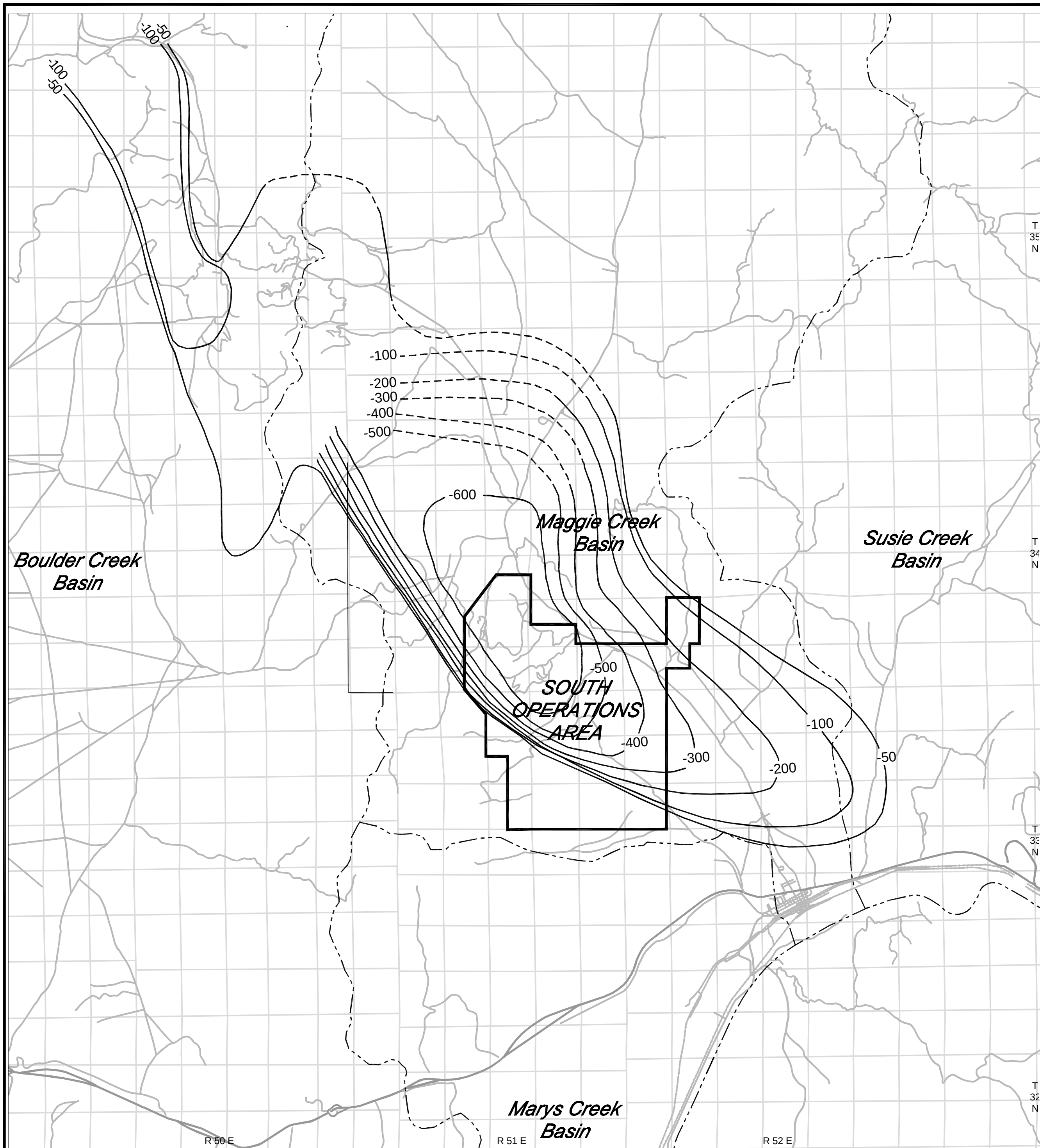
Some mine water was temporarily stored in Maggie Creek Ranch Reservoir. The largest part of the pumped water is discharged into Maggie Creek, less than 30 percent is used for mining and milling activities, and a smaller percentage is used for seasonal irrigation.

Groundwater Quality

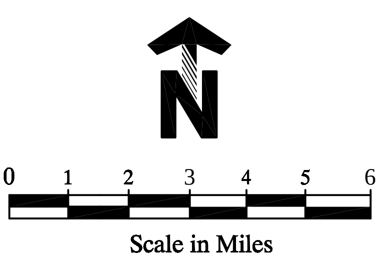
Groundwater quality for selected parameters in the study area is summarized in **Table 3-19**. Groundwater quality is influenced by geology, flow paths, residence time, and, in some cases, human factors. In general, water quality from all five major hydrostratigraphic units is similar; however, concentrations of ions are higher in the deeper units because of longer residence times. Groundwater from all hydrostratigraphic units is of the calcium-**bi**carbonate or sodium-**bi**carbonate type. Typical concentration ranges for selected chemical parameters are as follows: specific conductance = 100 to 700 µmhos/cm; total dissolved solids = 200 to 400 mg/L; pH = 6.5 to 8.5; dissolved oxygen = 2.5 to 6.0 mg/L; and temperature = 11 to 19°C (deeper units = 23 to 33°C).

Quality of groundwater to be pumped from the South Operations Area has been characterized by wells completed in the carbonate unit. Hardness of deeper groundwater is approximately 250 mg/L and total dissolved solids ranges from about 270 to 480 mg/L.

Deep water temperature ranges from 12°C to 34°C and pH ranges from 6.8 to 8.4. Geothermal gradients observed in some South Operations Area wells range from 0.6 to 4°C per 100 feet (Stone and Leeds, 1991). Groundwater parameters in the carbonate rock that have exceeded drinking water standards include arsenic, iron, and manganese (**Table 3-19**). Manganese and iron are the metals that most often exceeded drinking water standards in groundwater. Highest concentrations of arsenic are found in well SIC-1 in the Carlin Formation, with a total concentration of 0.11 mg/L. Groundwater quality may not be lowered below state or federal regulations



Source: Newmont 1999c

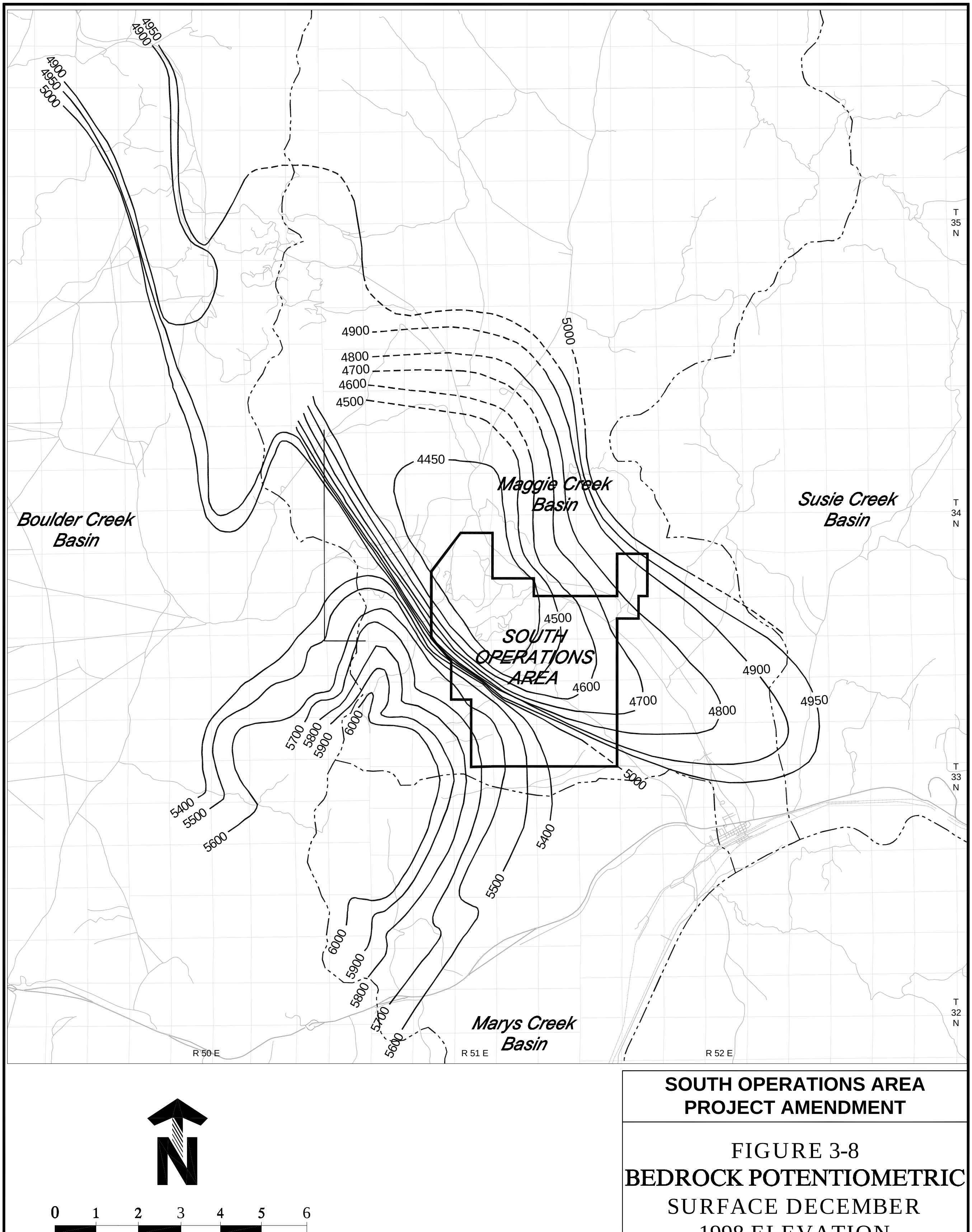


Contour interval in feet

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-7
BEDROCK POTENTIOMETRIC SURFACE CHANGE FROM PRE-DEWATERING ELEVATION

MINE AREA: SOUTH AREA	
DATE: 8/16/00	ACAD FILE: Fig3-7.dwg
SCALE: AS NOTED	DRAWN BY: ML, MODIFIED BY DS



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-8
BEDROCK POTENTIOMETRIC SURFACE DECEMBER 1998 ELEVATION

MINE AREA: SOUTH AREA	
DATE: 8/16/00	ACAD FILE: Fig3-8.dwg
SCALE: AS NOTED	DRAWN BY: ML, MODIFIED BY DS

TABLE 3-17
SUMMARY OF GROUNDWATER LEVELS IN SELECTED WELLS IN THE SOUTH OPERATIONS STUDY AREA[1]

Well	Screened Formation	Ground Elevation ft(msl)	Minimum Water Level ft(msl)	Month/ Year	Maximum Water Level ft (msl)	Month/ Year	Range of Water Level ft	Period of Record
JKC-1	Alluvium	5541	5506	Jul-96	5531	Apr-96	26	Dec-91 - Dec-98
JKC-2	Alluvium	5543	5516	Oct-92	5530	Apr-96	13	Dec-91 - Dec-98
MYC-2	Tertiary Volcanics	4953	4928	Jul-92	4936	Jun-98	8	Aug-91 - Dec-98
SIC-1	Carlin Formation	5355	5298	Sep-94	5302	Sep-98	5	Dec-91 - Dec-98
NMC-2	Carlin Formation	5148	5151	Sep-98	5159	Apr-93	8	Sep-92 - Dec-98
29-7	Carlin Formation	5149	5004	Jan-93	5038	Nov-98	34	Jun-92 - Dec-98
29-8	Carlin Formation	5086	5017	Jul-92	5058	Nov-98	42	Jun-92 - Dec-98
MYC-1	Carlin Formation	5022	4919	Jun-92	4928	Jul-96	9	Aug-91 - Dec-98
LJKC-1	Siltstone	5775	5781	Sep-96	5788	Jun-92	8	Jun-92 - Dec-98
MC-2	Limestone	5196	4404	Dec-98	4889	May-94	486	May-94 - Dec-98
CS-2	Limestone	5958	5989	Oct-92	6024	Jun-92	36	Jun-91 - Dec-98
GQP-15	Limestone	5726	4416	Dec-98	5028	May-92[2]	612	May-92 - Dec-98
GQP-37	Limestone	5277	4377	Nov-98	5031	May-92[2]	654	May-92 - Dec-98

Source: Newmont, 1999c.
1 Water Levels were generally measured monthly.
2 Estimate.

TABLE 3-18
WATER PRODUCTION AND USE 1994 - 1998

Million Gallons	1994	1995	1996	1997	1998
Total Production	7325.17	7980.45	8290.33	9093.29	8749.94
(acre-feet per year)	22,470	24,493	25,444	27,910	26,850
Discharge	2880.47	5195.36	4876.20	6186.80	6017.46
Irrigation	1632.21	612.18	873.76	951.38	1024.37
Mining & Milling	1638.21	2264.15	1584.14	1416.10	1181.05
Storage[1]	1174.28	-91.24	81.47	-154.64	-29.32
Miscellaneous[2]			874.76	693.65	556.38

Source: Newmont, 1999c.
1 Negative storage equals discharge from storage.
2 Metering error, evaporation, and infiltration.

TABLE 3-19
SUMMARY OF GROUNDWATER QUALITY IN THE SOAPA STUDY AREA

Well (Period of Record)	Total Concentration Statistics[1,2]	Temp °C	pH SU	Alk mg/l	Cond uMHOS/cm	Hard mg/l	TDS mg/l	TSS mg/l	Turb NTU	Ag mg/l	As mg/l	Ba mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Fe mg/l	Hg mg/l	Mn mg/l	Pb mg/l	Se mg/l	Zn mg/l
	No. of Samples	14	17	13	15	4	16	16	16	4	16	4	8	17	17	17	8	17	17	17	17
	Minimum	9.7	8.88	100	188	260	210	bdl	0.70	bdl	bdl	0.27	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
JKC-1	Average	13.8	11.44	657	2884	630	808	41.7	9.16	bdl	bdl	0.61	bdl	0.009	0.003	0.06	bdl	0.01	bdl	bdl	0.013
(1992-1996)	Maximum	17.2	12.36	1640	7300	1300	2082	109.0	30.00	bdl	bdl	1.20	bdl	0.012	0.005	0.33	bdl	0.07	bdl	bdl	0.060
	No. above Detection Limit	14	17	13	15	4	16	15	16	0	0	4	0	2	1	9	0	8	0	0	4
	No. above Water Standard	0	17	0	0	0	8	10	6	0	0	0	0	1	0	1	0	1	0	0	0
	No. of Samples	4	4	0	4	0	4	4	4	0	4	0	0	4	4	4	0	4	4	4	4
	Minimum	10.1	7.68		380		194	29.0	38.00		0.016			bdl	bdl	5.65		1.57	bdl	bdl	bdl
JKC-2	Average	12.2	7.89		416		226	52.9	41.23		0.017			bdl	0.007	5.89		1.64	bdl	bdl	0.017
(1996-1998)	Maximum	15.8	7.97		439		262	75.5	46.00		0.018			bdl	0.009	6.14		1.74	bdl	bdl	0.040
	No. above Detection Limit	4	4		4		4	4	4		4			0	3	4		4	0	0	3
	No. above Water Standard	0	0		0		0	4	4		0			0	0	4		4	0	0	0
	No. of Samples	20	21	13	20	4	20	20	20	5	21	5	8	21	21	21	8	21	21	21	21
	Minimum	13.8	6.52	86	79	87	149	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
MYC-2	Average	15.8	7.82	117	269	106	195	2.6	0.25	bdl	0.008	0.08	bdl	0.007	bdl	0.02	0.0002	0.00	bdl	bdl	0.006
(1992-1998)	Maximum	18.5	8.30	150	333	150	290	11.7	0.80	bdl	0.012	0.17	bdl	0.006	bdl	0.14	0.0002	0.01	bdl	bdl	0.014
	No. above Detection Limit	20	21	13	20	4	20	2	12	0	19	4	0	1	0	6	1	3	0	0	3
	No. above Water Standard	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	No. of Samples	20	22	14	21	5	21	21	21	6	22	6	9	22	22	22	9	22	22	22	22
	Minimum	10.8	6.43	112	105	140	208	bdl	1.45	bdl	bdl	0.11	bdl	bdl	bdl	0.27	bdl	1.11	bdl	bdl	bdl
SIC-1	Average	13.1	7.68	137	404	146	258	54.5	21.99	bdl	0.044	0.21	bdl	0.012	bdl	2.09	0.0005	1.26	0.007	bdl	0.012
(1992-1998)	Maximum	16.0	8.35	146	465	160	290	570.0	200.00	bdl	0.110	0.37	bdl	0.058	0.047	15.00	0.0011	1.50	0.019	bdl	0.090
	No. above Detection Limit	20	22	14	21	5	21	18	21	0	20	6	0	5	3	22	4	22	3	0	10
	No. above Water Standard	0	1	0	0	0	0	6	5	0	4	0	0	3	0	21	4	22	3	0	0
	No. of Samples	20	22	14	21	5	21	21	21	6	22	6	9	22	22	22	9	22	21	22	22
	Minimum	21.9	6.76	130	303	33	208	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
NMC-2	Average	30.7	8.03	140	377	37	237	2.4	0.47	bdl	0.020	0.09	bdl	0.007	bdl	0.11	0.0003	0.03	0.005	bdl	0.010
(1992-1998)	Maximum	36.8	8.47	150	475	46	266	8.0	1.60	bdl	0.032	0.12	bdl	0.009	bdl	0.20	0.0008	0.09	0.004	bdl	0.070
	No. above Detection Limit	20	22	14	21	5	21	5	20	0	21	5	0	1	0	21	1	19	1	0	6
	No. above Water Standard	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0
	No. of Samples	20	21	13	20	5	21	20	20	5	21	5	10	21	21	21	10	21	21	21	21
	Minimum	15.1	6.58	143	445	190	300	bdl	0.20	bdl	bdl	0.09	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
29-7	Average	17.3	7.87	178	525	194	339	5.9	1.07	bdl	0.006	0.10	bdl	0.006	bdl	0.04	0.0002	0.00	0.004	0.002	0.012
(1992-1998)	Maximum	19.6	8.38	200	576	200	380	42.0	11.00	bdl	0.009	0.10	bdl	0.005	bdl	0.30	0.0009	0.01	0.002	0.001	0.100
	No. above Detection Limit	20	21	13	20	5	21	9	20	0	19	5	0	3	0	12	1	2	1	1	11
	No. above Water Standard	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	1	0	0
	No. of Samples	20	21	13	20	5	21	20	20	5	21	5	10	21	21	21	10	21	21	21	21
	Minimum	11.1	6.76	170	121	150	320	bdl	bdl	bdl	0.009	0.15	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
29-8	Average	14.7	7.88	199	673	186	442	2.6	0.35	bdl	0.015	0.29	bdl	bdl	bdl	0.02	bdl	0.00	bdl	0.003	0.010
(1992-1998)	Maximum	17.6	8.45	220	1322	200	835	8.0	2.40	bdl	0.022	0.59	bdl	bdl	bdl	0.04	bdl	0.02	bdl	0.008	0.060
	No. above Detection Limit	20	21	13	20	5	21	3	14	0	21	5	0	0	0	6	0	1	0	4	12
	No. above Water Standard	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	No. of Samples	20	21	13	20	4	20	20	20	5	21	5	8	21	21	21	8	21	21	21	20
	Minimum	10.3	6.30	88	91	150	149	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
MYC-1	Average	14.3	7.84	133	345	150	218	2.6	0.36	bdl	0.002	0.07	bdl	bdl	0.003	0.02	0.0002	bdl	bdl	0.002	0.005
(1992-1998)	Maximum	18.6	8.43	160	458	150	264	6.4	1.30	bdl	0.005	0.08	bdl	bdl	0.005	0.04	0.0001	bdl	bdl	0.002	0.011
	No. above Detection Limit	20	21	13	20	4	20	5	14	0	4	4	0	0	1	4	1	0	0	4	4
	No. above Water Standard	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	No. of Samples	18	19	13	17	4	18	18	18	5	19	5	8	19	19	19	8	19	19	19	19
	Minimum	11.8	6.73	100	337	88	210	bdl	bdl	bdl	0.006	0.05	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PW-4	Average	17.5	7.87	160	412	137	268	8.3	1.74	bdl	0.011	0.15	bdl	0.007	0.026	0.47	0.0002	0.01	0.008	0.002	0.020
(1992-1997)	Maximum	25.2	8.42	175	448	160	304	83.5	18.50	bdl	0.021	0.19	bdl	0.005	0.180	3.50	0.0001	0.07	0.019	0.002	0.117
	No. above Detection Limit	18	19	13	17	4	18	7	13	0	19	5	0	1	8	16	1	5	4	3	10
	No. above Water Standard	0	0	0	0	0	0	1	1	0	0	0	0	0	0	4	1	1	4	0	0
	No. of Samples	18	21	13	19	4	20	20	20	5	21	5	8	21	21	21	8	21	21	21	21
	Minimum	10.8	6.73	200	142	320	402	bdl	5.50	bdl	bdl	bdl	bdl	bdl	bdl	0.47	bdl	0.04	bdl	bdl	bdl
LJKC-1	Average	13.3	7.86	213	680	328	450	2.5	13.93	bdl	0.004	bdl	bdl	bdl	bdl	1.13	bdl	0.05	bdl	bdl	0.006
(1992-1998)	Maximum	16.0	8.32	236	816	340	480	6.0	28.00	bdl	0.009	bdl	bdl	bdl	bdl	2.23	bdl	0.08	bdl	bdl	0.020
	No. above Detection Limit	18	21	13	19	4	20	4	20	0	9	0	0	0	0	21	0	21	0	0	4
	No. above Water Standard	0	0	0	0	0	0	0	13	0	0	0	0	0	0	21	0	5	0	0	0

TABLE 3-19
SUMMARY OF GROUNDWATER QUALITY IN THE SOAPA STUDY AREA

Well (Period of Record)	Total Concentration Statistics[1,2]	Temp °C	pH SU	Alk mg/l	Cond uMHOS/cm	Hard mg/l	TDS mg/l	TSS mg/l	Turb NTU	Ag mg/l	As mg/l	Ba mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Fe mg/l	Hg mg/l	Mn mg/l	Pb mg/l	Se mg/l	Zn mg/l
GQDW-10 (1995-1998)[3]	No. of Samples	13	12	1	12	0	13	11	11	0	13	0	0	12	12	12	0	12	12	12	12
	Minimum	29.0	7.86	272	593		321	bdl	bdl		0.021			bdl	bdl	bdl		bdl	bdl	bdl	bdl
	Average	30.3	8.14	272	633		363	2.5	0.59		0.023			bdl	0.005	0.12		bdl	0.004	bdl	0.025
	Maximum	33.0	8.31	272	726		417	2.6	2.20		0.030			bdl	0.014	0.47		bdl	0.008	bdl	0.048
	No. above Detection Limit	13	12	1	12		13	1	9		13			0	3	9		0	3	0	11
	No. above Water Standard	0	0	0	0		0	0	0		0			0	0	1		0	3	0	0
GQDW-11 (1995-1998)[3]	No. of Samples	14	13	2	13	0	14	12	12	0	14	0	0	13	13	12	0	13	13	13	13
	Minimum	29.3	8.05	241	539		313	bdl	bdl		0.014			bdl	bdl	bdl		bdl	bdl	bdl	bdl
	Average	30.8	8.21	252	622		360	2.4	0.36		0.020			bdl	0.055	0.04		bdl	bdl	bdl	0.031
	Maximum	33.6	8.39	263	708		408	1.8	2.20		0.026			bdl	0.680	0.18		bdl	bdl	bdl	0.078
	No. above Detection Limit	14	13	2	13		14	1	6		14			0	1	6		0	0	0	11
	No. above Water Standard	0	0	0	0		0	0	0		0			0	0	0		0	0	0	0
GQDW-12 (1995-1998)[3]	No. of Samples	15	14	2	14	0	15	13	13	0	15	0	0	14	14	14	0	14	13	14	14
	Minimum	26.5	7.91	243	533		272	bdl	0.20		0.019			bdl	bdl	bdl		bdl	bdl	bdl	bdl
	Average	28.6	8.16	243	582		329	2.7	0.74		0.028			bdl	bdl	0.05		0.00	0.003	bdl	0.038
	Maximum	31.0	8.42	243	677		383	5.2	2.30		0.040			bdl	bdl	0.34		0.04	0.007	bdl	0.065
	No. above Detection Limit	15	14	2	14		15	2	13		15			0	0	11		1	1	0	13
	No. above Water Standard	0	0	0	0		0	0	0		0			0	0	1		0	1	0	0
GQDW-13 (1996)	No. of Samples	3	3	0	3	0	3	3	2	0	3	1	1	3	3	3	1	3	3	3	3
	Minimum	19.9	7.62		573		326	bdl	6.50		0.014	bdl	bdl	bdl	bdl	1.40	bdl	0.06	bdl	bdl	bdl
	Average	21.9	8.05		671		398	2.0	6.50		0.024	bdl	bdl	bdl	bdl	1.85	bdl	0.11	bdl	bdl	0.015
	Maximum	23.3	8.41		809		477	1.0	6.50		0.041	bdl	bdl	bdl	bdl	2.68	bdl	0.19	bdl	bdl	0.040
	No. above Detection Limit	3	3		3		3	1	2		3	0	0	0	0	3	0	3	0	0	1
	No. above Water Standard	0	0		0		0	0	0		0	0	0	0	0	3	0	3	0	0	0
GQDW-14 (1996-1998)[3]	No. of Samples	11	9	0	10	0	11	8	8	0	11	0	0	9	9	9	0	9	9	9	9
	Minimum	29.8	6.77		586		322	bdl	bdl		0.015			bdl	bdl	bdl		bdl	bdl	bdl	0.010
	Average	31.6	7.96		613		362	bdl	0.63		0.020			bdl	bdl	0.04		0.01	bdl	bdl	0.019
	Maximum	33.2	8.37		661		404	bdl	2.20		0.023			bdl	bdl	0.11		0.06	bdl	bdl	0.027
	No. above Detection Limit	11	9		10		11	0	6		11			0	0	7		1	0	0	9
	No. above Water Standard	0	0		0		0	0	0		0			0	0	0		1	0	0	0
GQDW-15 (1996-1998)[3]	No. of Samples	9	8	1	8	0	9	8	7	0	9	1	1	8	8	8	1	8	8	8	8
	Minimum	29.1	7.93	255	586		313	bdl	0.20		0.015	0.12	0.005	bdl	bdl	bdl	0.0010	bdl	bdl	bdl	0.012
	Average	31.5	8.05	255	614		346	2.3	0.53		0.019	0.12	0.005	0.008	0.005	0.07	0.0010	0.01	0.003	0.003	0.021
	Maximum	34.2	8.17	255	652		393	1.2	2.20		0.024	0.12	0.005	0.050	0.020	0.14	0.0010	0.02	0.005	0.006	0.050
	No. above Detection Limit	9	8	1	8		9	1	7		9	1	1	1	1	6	1	2	1	1	8
	No. above Water Standard	0	0	0	0		0	0	0		0	0	1	1	0	0	1	0	1	1	0
MC-2 (1992-1998)[3]	No. of Samples	23	22	11	23	3	23	21	21	4	24	4	7	22	22	22	7	22	22	22	22
	Minimum	27.0	6.80	240	530	220	330	bdl	bdl	bdl	0.014	0.08	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	Average	30.4	7.96	262	624	230	371	3.6	2.32	bdl	0.024	0.10	bdl	0.006	bdl	0.29	0.0004	0.00	bdl	bdl	0.018
	Maximum	33.1	8.36	278	700	240	432	15.0	20.00	bdl	0.078	0.11	bdl	0.005	bdl	3.50	0.0017	0.02	bdl	bdl	0.050
	No. above Detection Limit	23	22	11	23	3	23	6	16	0	24	4	0	1	0	19	2	3	0	0	18
	No. above Water Standard	0	0	0	0	0	0	0	1	0	1	0	0	0	0	5	2	0	0	0	0
CS-2 (1992-1998)	No. of Samples	20	21	12	20	4	20	20	20	5	21	5	8	21	21	20	8	21	21	21	21
	Minimum	12.3	6.83	238	139	280	290	bdl	8.30	bdl	bdl	bdl	bdl	bdl	bdl	1.10	bdl	0.12	bdl	bdl	bdl
	Average	15.6	7.77	262	574	305	349	6.8	31.08	bdl	0.002	bdl	bdl	0.007	bdl	3.46	0.0002	0.15	bdl	bdl	0.006
	Maximum	18.1	8.28	291	696	320	384	16.7	79.00	bdl	0.004	bdl	bdl	0.006	bdl	8.99	0.0001	0.19	bdl	bdl	0.012
	No. above Detection Limit	20	21	12	20	4	20	13	20	0	3	0	0	1	0	20	1	21	0	0	8
	No. above Water Standard	0	0	0	0	0	0	0	19	0	0	0	0	0	0	20	1	21	0	0	0
Maximum Detection Limit		NR	NR	NR	NR	NR	NR	5	0.20	0.050	0.005	0.10	0.010	0.050	5.000	0.10	0.0050	0.01	0.050	0.005	0.025
Drinking Water Standards[4]			6.5-8.5 (s)				500(s)			0.050	0.050	2.0	0.005	0.100	1.3	0.3(s)	0.002	0.05(s)	0.05	0.05	5.0(s)
Aquatic Life Standards[5]			6.5-9.0					25-80	10	0.009	0.18(d)-0.34(d)		0.0015(d)-0.006(d)	0.01(d)-0.015(d)	16.1(d)-25.3(d)	1.0	0.000012(d)-0.002		0.0016(d)-0.08(d)	0.005-0.02	0.145(d)-0.160(d)

Source: Newmont, 1999; NAC 445A.144

[1] Average values were calculated assuming half detection limit for values below detection limit.

[2] Samples collected generally quarterly; Alk. = Alkalinity; Cond. = Conductivity (field); Hard. = Hardness; TDS = total dissolved solids; TSS = total suspended solids; Turb. = turbidity; Ag = silver; As = arsenic; Ba = barium; Cd = cadmium; Cr = chromium; Cu = Copper; Fe = iron; Hg = mercury; Mn = manganese; Pb = lead; Se = selenium; Zn = zinc; °C = degree celsius; SU = standard pH units (lab measured); mg/l = milligrams per liter; uMHOS/cm = microhoms per cemtimenter; NTU = nephelometric turbidity units; bdl = below detection limits.

[3] Dewatering Well

[4] All concentrations reported are primary drinking water standards unless followed by (s) indicating secondary standards.

[5] All standards for metals are for total recoverable, unless noted with (d) for dissolved fraction.

Ag, Cd, Cu, Pb, and Zn concentration standards are calculated based on a hardness of 175 mg/l, representative of Maggie Creek and the Humboldt River.

For As, Cd, Cr, Cu, Hg, Pb, Se, and Zn low values are 96-hour average concentration limits, high values are 1-hour average concentration limits. Both may be exceeded only once every 3 years.

For Ag and Fe single concentration limits must not be exceeded.

prescribing standards for drinking water (NAC 445A.424). Limitations on degradation of water for mining operations are described in NAC 445A.424.

Groundwater Use

A total of 174 ground water rights and 41 applications for water rights (including those by the two major mining companies, Barrick Goldstrike Mines, and Newmont Mining Corporation, and their subsidiaries), are listed for the four basin area considered for this study (including cumulative impact analysis area). These 174 groundwater rights include vested groundwater rights and groundwater rights under permits and certificates, as well as five non-permitted single family wells.

Single family domestic wells do not need a permit, but must submit a well log. The five listed non-permitted wells are located close to the South Operation Area. The primary uses for the water of all wells are stock watering and irrigation. A list of ground water rights is available for inspection at the BLM Elko Field Office. Water rights issued for each use category are summarized below.

Irrigation and Stock. The four basin area contains 134 wells permitted for irrigation and stock use.

Municipal. The four basin area contains four wells permitted for municipal use; these wells are owned by the city of Carlin. All wells with municipal water rights are located near the mouths of Marys Creek and Maggie Creek. Additionally there are 6 wells for quasi-municipal purposes (e.g., for the prison department and transportation department).

Domestic. With few exceptions, a water right is not required to produce from a domestic well in Nevada. Several domestic wells were clustered in Section 9, T33N, R52E, approximately 2 miles east of the South Operations Area. These domestic wells were installed in a subdivision development (Goldview Estates) that has subsequently been acquired by Newmont (with one private parcel exception). Wells in the subdivision are screened in the range of 107 to 150 feet below ground surface and are no longer used for domestic purposes. Two additional domestic wells are located just west of Goldview Estates and are also owned by Newmont.

Industrial and Commercial. The four basin area also contains 16 wells permitted for industrial, commercial, environmental, and other purposes.

Mining/Milling and Construction. A total of 11 wells (excluding water rights owned by the two major mining companies) are permitted for mining and milling in the four basin area.

Hydrologic Monitoring Program

Newmont collects hydrologic information in the vicinity of the South Operations Area on a periodic basis as part of its ongoing monitoring program. Results of groundwater and surface water monitoring are submitted to the NDWR, NDEP, USGS and BLM. The Maggie Creek Basin Monitoring Plan was prepared to provide a method of evaluating potential impacts of mine activities and dewatering. Additional requirements for monitoring are outlined in the 1993 EIS (BLM, 1993). Hydrologic monitoring has established baseline data and reports evolving conditions for both groundwater levels and quality and surface water flow and quality.

Data collected by Newmont are supplemented by USGS information collected at surface water stations and groundwater monitoring wells.

Spring and seep surveys were initiated by Newmont in the fall of 1990. Sixty-two springs are currently monitored according to various schedules (Newmont, 1999b). Flow rates, pH, temperature, specific conductance, and dissolved oxygen are measured. Eight springs are monitored quarterly, 25 springs are **monitored** semi-annually, and an additional 37 springs are voluntarily monitored annually, typically in October. A summary of water quality of selected springs is shown in **Table 3-14**.

Surface water monitoring involves 29 stations on 12 streams and the Humboldt River. Discharge is measured using eight continuous recorders on Simon Creek, Maggie Creek, Marys Creek, Susie Creek, and the Humboldt River. Maggie Creek has three and the Humboldt River has two USGS surface water stations in the study area. On the remaining stations, point discharge measurements are taken monthly (**Figure 3-2**).

Ninety-four water wells are currently monitored by Newmont for water levels and/or water quality (Table 3-20 and Figure 3-6). Water levels are monitored monthly and water quality samples are taken annually. In addition, production wells are sampled quarterly for total dissolved solids and arsenic.

The USGS collects some of the hydrologic information outlined above as well as additional surface water and groundwater data in the project area. This information is presented annually in the USGS Water Resources Data reports for Nevada (for an example, see USGS, 1998). Hydrologic monitoring by Newmont will continue for a period of time **following closure**.

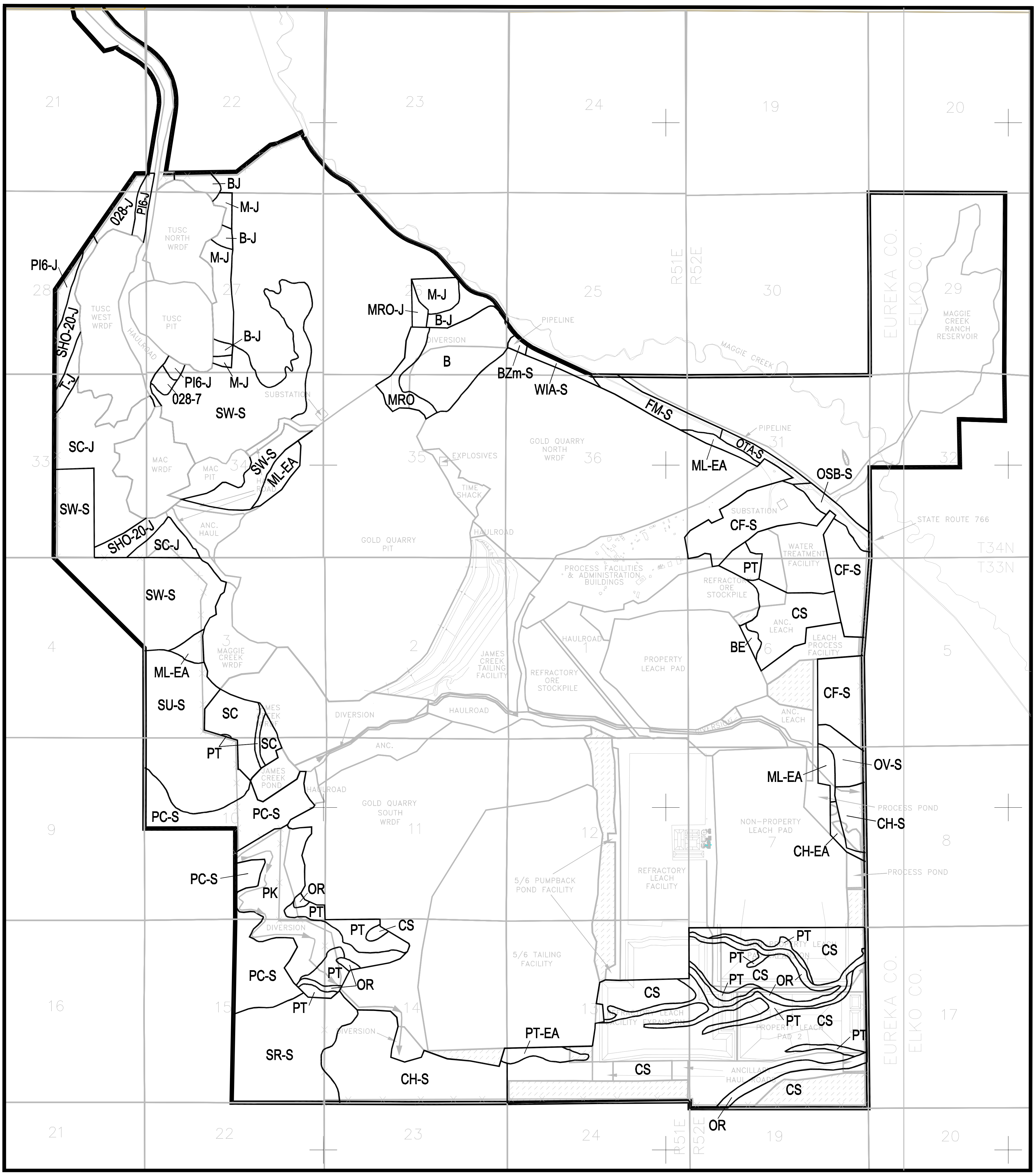
FLOODPLAINS

Federal Emergency Management Agency flood insurance maps delineating the 100-year floodplain have been prepared for the Humboldt River in the vicinity of Carlin (Federal Emergency Management Agency, 1984 and 1990). These maps show the Humboldt River has a floodplain ranging from 0.25 to 1.5 miles wide. The maps indicate that channel changes have occurred frequently and at different degrees at different locations. Flows have cut across meanders, eroded banks, and have the ability to scour and create bars and terraces. In some places, agriculture is practiced in the floodplain.

SOILS

The study area for soils comprised the undisturbed areas within the proposed SOAPA boundary of the South Operations Area Project. Soils within the study area have developed on lower mountain slopes and desert basin landforms including alluvial fans and terraces. Soils of the currently permitted South Operations Area were described in the previous EIS (BLM, 1993).

A composite of all soils mapping for the project area was included in a 1992 soils technical report (Westech, 1992). **Figure 3-9** indicates Order II soil mapping units for previously undisturbed portions of the study area. This map is based on previous soils mapping for the area, aerial photo interpretation, and field checking in September 1997.



LEGEND

PLAN OF OPERATIONS BOUNDARY

FACILITY BOUNDARY

SECTION LINE

TOPSOIL STOCKPILE

DIVERSION DITCHES

PERIMETER FENCES

ANC. = ANCILLARY DISTURBANCE

WRDF = WASTE ROCK DISPOSAL FACILITY

0 1/4 1/2 3/4 1

Scale in Miles

Soil Mapping Units by Source

I Soil mapping units in new areas to be disturbed under the South Operations Area Project Amendment:

BU	Bucan, 15-30% slopes
BE	Berning, 30-75% slopes
CS	Cherry Spring, 2-8% slopes
MR	Malpais-Rock Outcrop, 50-75% slopes
OR	Orovada, 4-15% slopes
PK	Pie Creek, 15-30% slopes
PT	Puett, 15-30% slopes
SC	Susie Creek, 4-15% slopes

II Soil mapping units delineated in the Newmont Inventory Soils and Vegetation Report or the Newmont Inventory Addendum Report (JBR 1992a and 1992b):

B-J	Bucan, 15-30% slopes
M-J	Malpais, 50-75% slopes
MRO-J	Malpais-Rock Outcrop, 50-75% slopes
O28-J	O28-J Orovada, 4-15% slopes
P16-J	Puett, 4-75% slopes
SC-J	Susie Creek, 4-15% slopes
SHO-20-J	Short Creek, 30-75% slopes
T-J	Toeja, 4-30% slopes

III Soil mapping units delineated in the USDI, Bureau of Land Management, Environmental Assessment, Gold Quarry Mill 2/5 Tailing Facility Report (BLM 1991):

CH-EA	Cherry Spring, 2-8% slopes
ML-EA	Mine-Related Disturbed Land
PT-EA	Puett, 15-30% slopes

IV Soil mapping units delineated in the USDA, Soil Conservation Service, Soil Survey of the Tuscarora Mountain Area, Nevada (USDA 1980):

BZm-S	Bucan-Malpais, 15-75% slopes
CF-S	Berning-Cherry Spring, 2-30% slopes
CH-S	Cherry Spring-Cortez-Tomera, 2-8% slopes
FM-S	Four Star, 0-2% slopes
OSB-S	Orovada, 2-4% slopes
OTA-S	Orovada, 0-20% slopes
OV-S	Orovada, 4-30% slopes
PC-S	Pie Creek-Susie Creek-Toeja, 4-30% slopes
SR-S	Stampede-Donna, 2-15% slopes
SU-S	Susie Creek-Pattani, 4-15% slopes
SW-S	Susie Creek-Short Creek-Toeja, 4-50% slopes
WIA-S	Wholan, 0-2% slopes

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-9
SOIL MAPPING UNITS

MINE AREA: SOUTH AREA	
DATE: 6/6/00	ACAD FILE: Fig3-9.DWG
SCALE: 1"=3000'	DRAWN BY: ML, MODIFIED BY: WM

TABLE 3-20
SOAPA STUDY AREA MONITOR WELLS[1]

Well ID	Screen Interval Feet	Total Depth Feet	Monitoring	
			Water Level	Water Quality
PIT AREA MONITOR WELLS				
Siltstone				
GQP-61	360-400	400	X	
J-1	440-460	500	X	
Limestone				
GQDW-10	514-1274	1325		X
GQDW-11	588-1284	1325		X
GQDW-12	716-1556	1610		X
GQDW-13	970-1650	1670		X
GQDW-14	660-1380	1400		X
GQDW-15	708-1548	1550		X
GQDW-16	640-1400	1500		X
GQP-15	1580-1600	1600	X	
GQP-18	1580-1600	1600	X	
GQP-32	440-460	460	X	
GQP-32A	979-999	1000	X	
GQP-37	1158-1178	1178	X	
GQP-38	927-947	950	X	
GQP-40	1140-1160	1200	X	
GQP-41	1165-1185	1200	X	
GQP-42	2797-2817	2817	X	
GQP-44	1580-1600	1600	X	
GQP-45	1564-1584	1585	X	
GQP-48	1679-1699	1700	X	
GQP-52	1470-1490	1498	X	
J-2D	700-720	735	X	
MC-2	1041-1201	1208	X	X
Carlin Formation				
GQP-57	640-660	660	X	
REGIONAL MONITOR WELLS				
Siltstone				
CS-1	280-300	320	X	
CUP-2	390-410	425	X	
CUP-3	380-400	405	X	
GQP-58A	1355-1375	1380	X	

TABLE 3-20 (continued) SOAPA STUDY AREA MONITOR WELLS[1]				
		Total	Monitoring	
Well ID	Screen Interval Feet	Depth Feet	Water Level	Water Quality
HW-1S	1120-1140	1755	X	
LJKC-1	440-500	500	X	X
MK-3	183-203	203	X	
ML-9	1579-1599	1600	X	
MYC-3	1013-1033	1035	X	
PAL-1	278-298	300	X	
TSN-53	525-545	820	X	
WCH-1	570-590	600	X	
Limestone				
CBN-3	575-580	580	X	
CS-2	425-625	625	X	X
CV-5	2730-2750	2750	X	
GQP-50	1278-1298	1300	X	
GQP-51	1179-1199	1200	X	
GQP-60A	2476-2496	2500	X	
HW-1D	1735-1755	1755	X	
ML-6	2484-2504	2505	X	
NS-1	521-821	841	X	
PAL-3A	980-990	1000	X	
GQP-49	1849-1869	1870	X	
GQP-53	2270-2290	2300	X	
GQP-54	1680-1700	1823	X	
GQP-55	1230-1250	1670	X	
GQP-56	980-1020	1020	X	
Carlin Formation				
29-2	130-140	142	X	
29-7	165-184	185	X	X
29-8	69-89	90	X	X
G-66	65-145	145	X	
GQP-57	640-660	660	X	
MK-1	476-505	505	X	
MK-2	180-200	200	X	
MYC-1	655-675	675	X	X
MYC-4	250-270	270	X	
NMC-2	178-958	1000	X	X
NS-2A	980-100	1000	X	
NS-2B	560-580	580	X	
NS-2C	440-460	463	X	
PETRO-CHEM	75-175	187	X	
PW-4	140-520	540		X

TABLE 3-20 (continued)
SOAPA STUDY AREA MONITOR WELLS[1]

Well ID	Screen Interval Feet	Total Depth Feet	Monitoring	
			Water Level	Water Quality
SC-2	80-100	100	X	
SIC-1	170-180	230	X	X
WW-9	50-700	700	X	
Tertiary Volcanics				
GQP-46	380-400	400	X	
MYC-2	74-84	85	X	X
SC-1	120-140	140	X	
USGS-3	278-298	305	X	
USGS-4	77-97	105	X	
USGS-5	152-172	175	X	
Alluvium/Colluvium				
COY-1	95-110	110	X	
COY-2	45-50	50	X	
CV-10	1415-1435	1435	X	
GQP-59	55-65	65	X	
JKC-1	308-318	320	X	
JKC-2	48-58	60	X	X
JKC-3	35-40	40	X	
JKC-4	65-70	70	X	
MAG-A	35-40	40	X	
MAG-B	25-30	30	X	
MAG-C	25-30	30	X	
MAG-D	25-30	30	X	
MG-1	63-68	70	X	
MG-2	69-75	75	X	
MG-3	58-63	65	X	
MG-4	63-68	105	X	
NS-3C	500-520	525	X	
PAL-4	72-82	82	X	

Source: Newmont, 1999c.
[1] See **Figure 3-6** for locations of wells.

Soil classifications for the study area indicate diversity in soil development as well as limitations to plant growth. Limiting factors affecting usefulness of salvaged soils for reclamation include salts, coarse fragments, **and** texture**.** Flooding frequency and shallow depth to water table do not appear to be limiting factors for study area soils. **Table 3-21** lists the eight soil mapping units identified within previously undisturbed portions of the amendment area. Soil salvage depths listed for each mapping unit are based on previous baseline reports, 1997 field observations, and Table 620-11 in the National Soil Survey Handbook (USDA SCS, 1993).

Six of the eight soil mapping units have been found suitable for reclamation and salvageable to depths estimated to range from six to 24 inches (**Table 3-21**). Two soil mapping units are unsuitable because of excessive stoniness within the profile and their presence on slopes which are too steep for effective salvage.

The Carlin Formation material being mined from the pit can serve as supplemental growth medium during reclamation. While Newmont is not currently stockpiling this material, they plan to create a stockpile for the closure and reclamation of the Refractory Leach Facility. **Currently, Newmont has salvaged and stockpiled approximately 2.5 million cubic yards of topsoil in seven soil stockpiles.**

VEGETATION

The study area for vegetation is the same as described in the original EIS (BLM, 1993) and includes the amendment area. The vegetative landscape in the vicinity of the Carlin Trend is characterized by sagebrush steppe and a scattering of riparian communities bordering drainages, springs and seeps. BLM Standard Ecological Site Description methods, which use soils information in addition to plant species composition, have been used to describe the vegetation in terms of ecological range sites (JBR, 1992c). Nine range site types were identified within the study area (BLM, 1993) which is defined as an area of 11,636 acres in parts of 20 sections comprising the South Operations Area. Their mapped extent, and detailed descriptions of each are provided in the original EIS (BLM, 1993). Of the nine range site types identified within the study area, two types, loamy 8-10 inch precipitation zone and loamy 10-12 inch precipitation zone, accounted for 80 percent of the 11,636 acre area (BLM, 1993) (**Table 3-22**).

Vegetation cover on the loamy 10-12 inch precipitation zone was dominated by shrubs (22 percent), including basin sagebrush, Wyoming big sagebrush and mountain sagebrush and Douglas rabbitbrush. Sandberg bluegrass, bottlebrush squirreltail, Great Basin wildrye, and bluebunch wheatgrass were also common. The loamy 8- to 10-inch precipitation zone range type exhibited a slightly smaller proportion (18 percent) of shrubs. Here, Wyoming big sagebrush was codominant with Sandberg bluegrass, bottlebrush squirreltail, Thurber needlegrass, and bluebunch wheatgrass.

Of the 11,636 acres within the study area, 7,960 acres are areas that either have existing disturbance or are approved for disturbance. The remaining 3,676 acres (32 percent) of the surveyed area is undisturbed. For SOAPA, 1,392 acres of new disturbance is proposed. A summary of the range sites is provided in **Table 3-23**.

TABLE 3-21
SOIL MAPPING UNITS WITHIN THE SOAPA AREA

Map Symbol	Mapping Unit	Parent Material	Landscape Position	Salvage Depth[1]
BU	Bucan, 15-30% slopes	Loess high in volcanic ash over residuum from volcanic rock	hilly uplands	18
BE	Berning, 30-75% slopes	Alluvium from mixed rock sources	terrace breaks	0[2]
CS	Cherry Spring, 2-8% slopes	Loess high in volcanic ash over mixed alluvium	dissected low terraces	24
MR	Malpais-Rock Outcrop, 50-75% slopes	Colluvium from volcanic rock	canyon walls and rock outcrops	0[2]
OR	Orovada, 4-15% slopes	Loess high in volcanic ash, alluvium from mixed rock sources	lower parts of fans and terraces	18
PK	Pie Creek, 15-30% slopes	Residuum from tuff, tufaceous sandstone and mixed rocks, volcanic ash and loess	side slopes of upland hills	6
PT	Puett, 15-30% slopes	Residuum from tuff, tufaceous sandstone and mixed rocks, volcanic ash and loess	upper parts of upper alluvial terraces and slopes	12
SC	Susie Creek, 4-15% slopes	Residuum from tuff, tufaceous sandstone and mixed rocks, volcanic ash and loess	uplands	18

1 Based on previous soil surveys and sampling/field observations, September 1997.
2 Too steep and stony to salvage.

TABLE 3-22
RANGE SITES WITHIN THE SOAPA STUDY AREA

Range Site	Percent
loamy 8-10	59
loamy 10-12	21
chalky knoll	5
dry floodplain	<1
south slope	3
churning clay	3
shallow loam	<1
claypan 10-12	4
riparian	5

Source: BLM, 1993. Area in 1993 comprised 11,636 acres.

TABLE 3-23 ACRES* PROPOSED FOR DISTURBANCE BY RANGE SITES IN THE SOAPA STUDY AREA		
Land Status	**Range Site Name**	**Acres**
Previously Undisturbed	loamy 8-10	1109
	loamy 10-12	141
	south slope	41
	claypan 12-16	101
	Total	**1392**

* Total acres disturbed (new and previous) are from **Table 2-6**. Range site acres are estimated based upon amendment shown in **Figure 2-3**.

TABLE 3-24 NOXIOUS WEEDS IN THE SOAPA STUDY AREA		
Designation	**Plant Species**	**Scientific Name**
Listed by the State of Nevada as "noxious weeds"	Scotch thistle	*Onapardum acanthium*
	Canada thistle	*Cirsium arvense*
	Hoary cress	*Cardaria draba*
	diffuse knapweed	*Centaurea diffusa*
	Russian knapweed	*C. repens*
	spotted knapweed	*C. maculosa*
	saltcedar	*Tamarix ramosissima*
	musk thistle	*Carduus nutans*
	perennial pepperweed	*Lepidium latifolium*
	poison hemlock	*Conium maculatum*

Source: BLM, 2000d.

NOXIOUS WEEDS

Several undesirable plant species are present within the project area (**Table 3-24**). There are three main species of concern in the project area; scotch thistle, Canada thistle, and salt cedar or "tamarisk." The Maggie Creek drainage immediately below Newmont's main facilities contains Scotch thistle, as do many sites throughout the study area. This species can grow up to 6 feet tall and is armed with spines, making it the most troublesome weed in the study area (BLM, 1993). Because livestock will not move through its dense infestations, it can make an area ungrazable. This weed is a prolific seed producer and its seed remains viable for several years, making it very difficult to eradicate.

The noxious weed inventory that Newmont conducted in Fall 1998 (JBR, 1998) indicated that noxious weeds were present on approximately 101 acres in the South Operations Project area. Predominant weeds present were scotch thistle, Canada thistle, and saltcedar. Areas with more than a half-acre of weeds include the James Creek diversion channel, the James Creek pond and diversion dam area, the northeast and northwest sides of the Gold Quarry North WRDF, and along the haul road on the northwest side of the Gold Quarry pit. Most all sites are primarily scotch thistle. Canada thistle occurs in the James Creek pond and diversion dam area, and saltcedar occurs on the James Creek tailing storage area.

A supplemental survey (Marinovich, 1998) identified scotch thistle present in the east half of Section 10, T33N, R51E, and in Section 18, T33N, R52E. These two locations are areas proposed for expansion as part of the SOAPA project.

RIPARIAN AREAS, WETLANDS AND WATERS OF THE U.S. AREAS

In 1993, the study area for riparian, wetland, and waters of the U.S. was the Maggie Creek, Susie Creek, Marys Creek basins and the Humboldt River from 6 miles above Carlin downstream to 6 miles below Buck Rake Jack Creek. Riparian areas and wetlands are associated with perennial and intermittent streams (JBR, 1993; Whitehorse Associates, 1995), the Humboldt River (JBR, 1992a; Rawlings and Neel, 1989), and springs and seeps (JBR, 1992b and Cedar Creek, 1997).

Waters of the U.S. are also associated with ephemeral channels which have defined water flow boundaries. Riparian areas associated with the Humboldt River and tributaries within the study area were described in the original EIS (BLM, 1993).

Riparian Areas

Thirteen riparian vegetation types are present along tributaries to the Humboldt River within the study area (JBR, 1993). Approximately 2,136 acres of riparian areas are present within the 1993 study area. The affected riparian environments for SOAPA would include upper Lynn Creek, Fish Creek, a short segment of Marys Creek, and Maggie Creek. The most extensive riparian zones are associated with Maggie Creek (1,336 acres). **Other streams with large riparian areas include lower Susie Creek (263 acres), Jack and Little Jack creeks (214 acres), and Coyote and Spring creeks (133 acres).** All other streams have less than 40 acres each of associated riparian vegetation. The most common riparian types associated with tributary drainages include upland meadow, streamside sedge meadow, grassy wet meadow, grassy meadow, B1 bench and B2 bench. **B1 benches are above the streamside type on stream-deposited terraces and below the overall high water mark. B2 benches are secondary terraces above the B1 bench and above the overall high water mark.**

The types of wetlands present along the three smaller streams (not Maggie Creek) are dominated by streamside, B1 bench, B2 bench, and willow thickets. Upper Lynn Creek is restricted to streamside wetlands. Fish Creek is almost exclusively streamside and B1 bench wetlands, with a small component of yellow willow thicket. Marys Creek also has cattail/pond wetlands. In addition to all these wetland types, Maggie Creek also has large components of sedge meadows, rush meadows, grassy meadows and wet grassy meadows.

As part of the Mitigation Plan for the development of the South Operations Area Project, Newmont Mining Corporation, in conjunction with the Elko BLM and Elko Land and Livestock Company, developed the Maggie Creek Watershed Restoration Project (MCWRP) in 1993 to improve streams, riparian habitats, and watershed conditions within the Maggie Creek subbasin (BLM, 1993). The MCWRP was designed to enhance 1,982 acres of riparian habitat, over 40,000 acres of upland watershed, and 82 miles of stream channel within the Maggie Creek subbasin (BLM, 1993). Components of the plan included enclosure and pasture fencing for livestock grazing management, conservation easements, water developments, water augmentation, riparian plantings, and other measures (**Appendix A** Progress Report and Monitoring Analysis). Restoration of Lahontan cutthroat trout habitat was a key consideration in development of the plan.

The MCWRP includes the management and monitoring of stream and riparian habitats associated with Maggie, Coyote, Indian Jack, Little Jack, Lynn, and Simon creeks. An additional 23 springs sites were also fenced and developed where possible to provide alternate sources of water for livestock. Streams and associated riparian habitats are included within 16 pastures. Changes in grazing management on these areas have included total exclusion of livestock; exclusion of livestock until selected biological standards have been met followed by limited, prescription grazing; and, application of various grazing systems. An additional four pastures controlled by Maggie Creek Ranch were initially identified for improvement in the MCWRP; however, no changes in management of these areas is known to have occurred.

Condition of both flowing and standing water riparian habitats within the Maggie Creek basin has improved substantially as a result of implementation of the MCWRP. For additional information refer to the affected environment section of Lahontan cutthroat trout in a following section – Threatened, Endangered, Candidate, and Sensitive Species.

Spring/Seep Wetlands

Spring and seep wetlands were described in the original EIS (BLM, 1993). Approximately 195 individual or groups of springs and seeps were inventoried within the study area (JBR, 1992b).

The total wetland area associated with inventoried springs and seeps in 1993 was approximately 204 acres, of which the majority was associated with a few large sites. Springs and seeps are shown in **Figure 3-4**.

Although springs and seeps and associated wetlands cover a small area relative to upland vegetation, they have the following important functions and values:

- Livestock and wildlife watering sources;
- Increased vegetation productivity;
- Ecological diversity; and
- Groundwater discharge.

Implementation of the Mitigation Plan in 1993 included the fencing of 25 spring/seep sites (approximately 14 acres of area) (**Appendix A**). Numerous other springs were located in pastures where grazing was restricted or eliminated and conditions at these springs have also improved. Six major livestock pastures had fencing installed from 1994-1996 (**Appendix A**). There are nine pastures that were designated "Riparian Restoration Zones" which had grazing excluded until certain standards were met; all of these are now being grazed in a manner to ensure maintenance of good riparian conditions. There are four pastures designated as "Controlled Grazing Zone"; all of these are being grazed to maintain good riparian conditions.

Newmont constructed an approximately 118 acre wetlands near the mouth of Maggie Creek. This wetland is located in an area between Interstate 80 and the East Carlin access road. A small diversion structure was placed in Maggie Creek to distribute a small amount of water along the upper end of the wetland area during the irrigation season. In the Dry Susie Creek basin, Newmont also created a wetlands near the Carlin tunnels, which comprise approximately 110 acres, but does not require diversion of water at all.

SOAPA Wetlands

The SOAPA consists of three specific areas of land where the site boundary is being expanded, including the entirety of Section 18, T33N, R52E, the east ½ of Section 15, T33N, R51E, and the northwest ¼ of Section 10, T33N, R51E. Evaluation (Cedar Creek, 1997) of these three areas for wetlands and Waters of the U.S. identified seven wetland areas (**Table 3-25**). These areas are shown on **Figure 3-10.**

With regard to the east half of Section 15, no wetlands or Waters of the U.S. are present. Section 18 contains a drainage which traverses the section from west to east and is classified as non-wetland Waters of the U.S. No other wetlands or waters were found to occur within Section 18.

The northwest ¼ of Section 10 contains several small wetlands. All wetlands are shown on **Figure 3-10** and are listed in **Table 3-25.**

Based on the 1993 jurisdictional survey, the Proposed Action was projected to impact 0.98 acres of Waters of the United States in Section 18, which consisted of an unnamed drainage of non-wetland waters that convey snowmelt and precipitation runoff across Section 18 on its way to entering Maggie Creek. On January 9, 2001, the U.S. Supreme Court issued its decision in Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers, which invalidated part of the regulatory definition of Waters of the United States. Given that decision, it is possible that certain of these previously identified waters are not jurisdictional. Thus, the prior delineation represents the maximum acreage of jurisdictional waters that may be affected. To the extent those waters still qualify as Waters of the United States, a 404 permit would be obtained from the Corps of Engineers, prior to construction of facilities that would impact those waters. All action alternatives would have impacts on wetlands and Waters of the U.S. similar to that of the Proposed Action.

TERRESTRIAL WILDLIFE

The Draft EIS for Newmont's South Operations Area Project (BLM, 1993) established the baseline for wildlife and aquatic resources. The study area for wildlife was an area roughly 20 by 30 miles centered on the South Operations Area Project. Rather than duplicate information contained in that document, this section describes only those issues and resources that have changed or are

TABLE 3-25
WETLANDS AND OTHER WATERS OF U.S. IN SECTIONS 10 AND 18

Location	Feature	Wetland Acreage	Non-Wetland Waters of the U.S. Acreage
T33N, R51W, Section 10, NW Quarter	James Creek	0.81	0.41
	Tributary to James Creek	0.06	0.06
	Wetland 1	0.28	
	Wetland 2	3.59	
	Wetland 3	1.24	
	Wetland 4	0.71	
	Wetland 5	0.53	
T33N, R52W, Section 18	Drainage (6000 feet)	0.00	0.89
Total		**8.11**	**1.36**

in need of further analysis. For more specific detail on any given species or groups of species, the reader should refer to the following referenced environmental documents for the South Operations Project Area:

- BLM, 1993
- JBR Environmental Consultants Inc., 1994; 1993; 1992a; 1992b; 1992c; 1992d; 1992e; 1992f; 1992g; 1990.

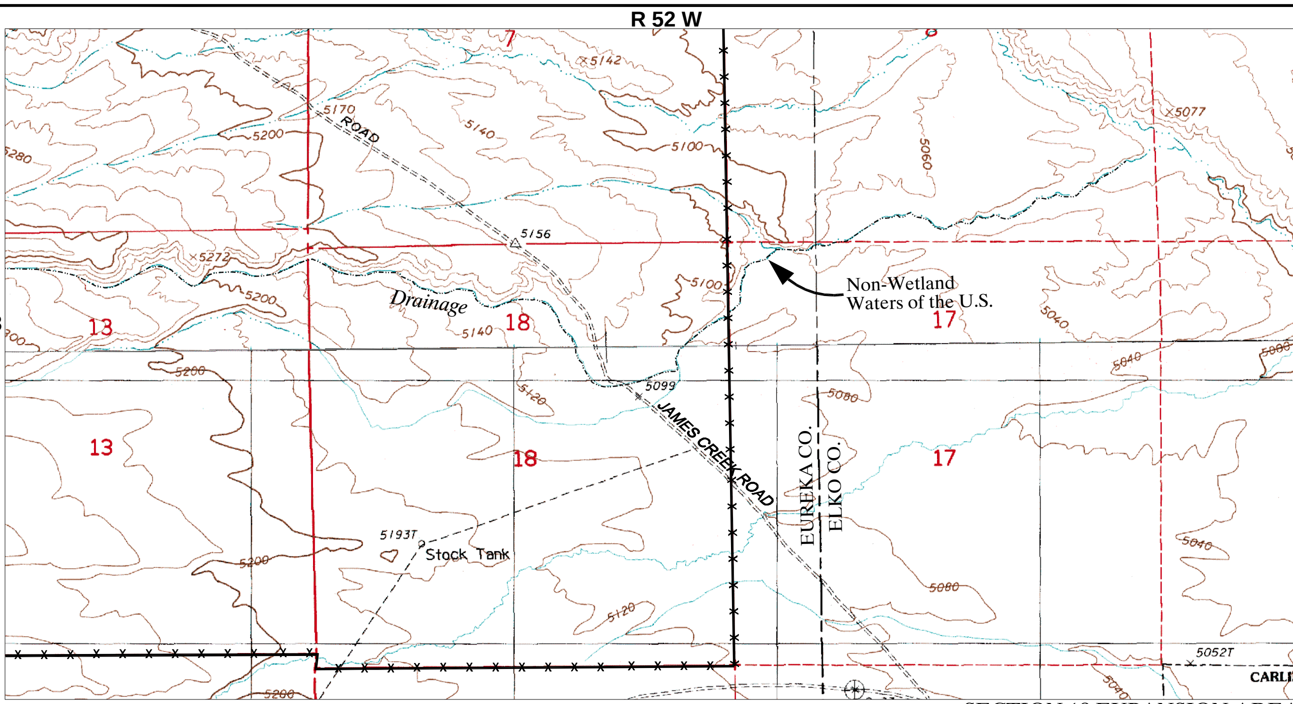
Mule deer are the principal big game species found throughout the project area which is located within NDOW's Management Area 6. The management area includes unit group 061-068. The population has experienced significant growth during the past four years as a result of good recruitment due to mild winters. The 1996 post season population estimate for unit group 061-068 was 13,000 animals, that is a 45 percent increase from the low that followed the severe winter of 1992-93.

Designated crucial summer range for mule deer occurs approximately 8 miles to the northeast along the Independence Range (BLM, 1993). Crucial winter range for mule deer is located approximately 1-mile to the south and extends along the southern end of the Tuscarora Mountains to the west of the project area (**Figure 3-11**).

Although no mule deer crucial habitat occurs within the project area, the northwest portion of the project area is considered transitional range. This transitional range is used as mule deer move from high summer elevations to lower winter ranges in the fall and reverse during the spring.

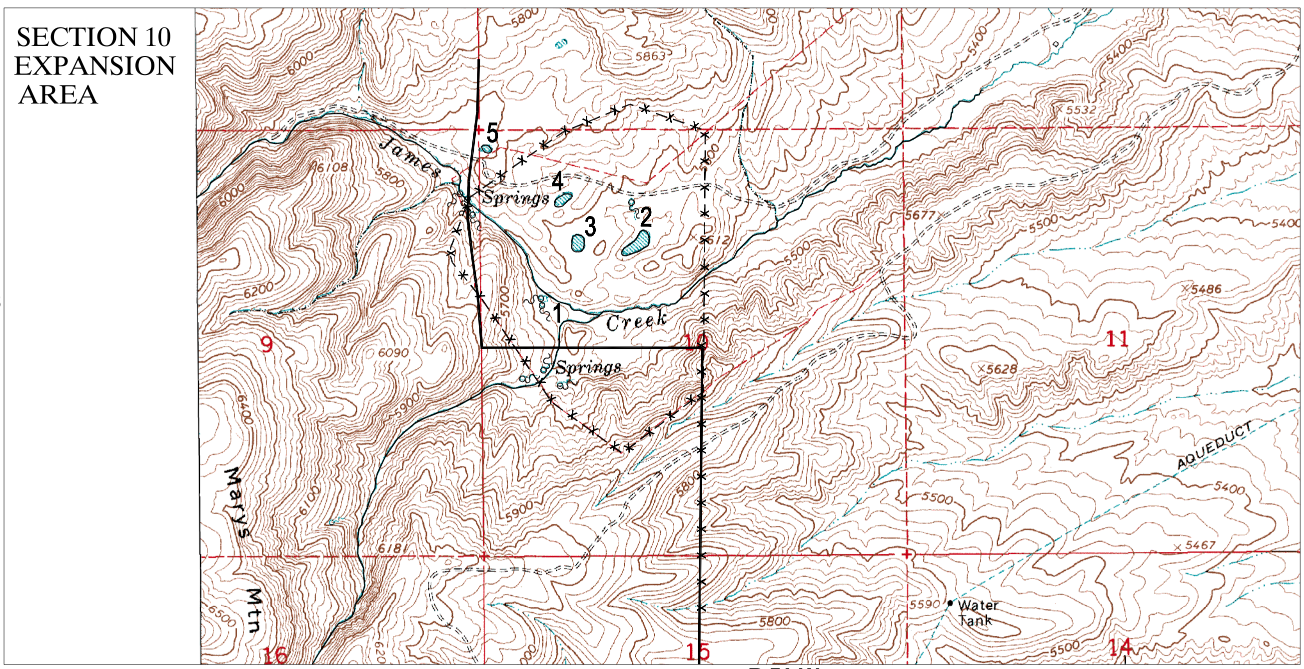
During the summer of 1996, northeastern Nevada experienced a bad fire season. Approximately 114,000 acres of deer habitat burned in Unit Group 067-068. Of this total, perhaps the most devastating loss was the 28,000 acres of crucial winter and transitional range near the south end of the Tuscarora Mountain Range. BLM and NDOW, in cooperation with Newmont and other concerned parties, are working to rehabilitate crucial range for mule deer in these areas. To date, approximately 5,814 acres of the most important habitat have been reseeded with a shrub, grass, and forb mix.

The pronghorn antelope within the project area are part of NDOW's Management Areas 6 and 7 which includes Unit Group 061, 062,



Source: USGS Quadrangles of Carlin West and Schroeder Mountain, Nevada.

SECTION 18 EXPANSION AREA



Source: USGS Quadrangles of Carlin West and Schroeder Mountain, Nevada.

R 51 W

LEGEND

- Wetlands
- Water of the U.S.
- Boundary
- Fence

N

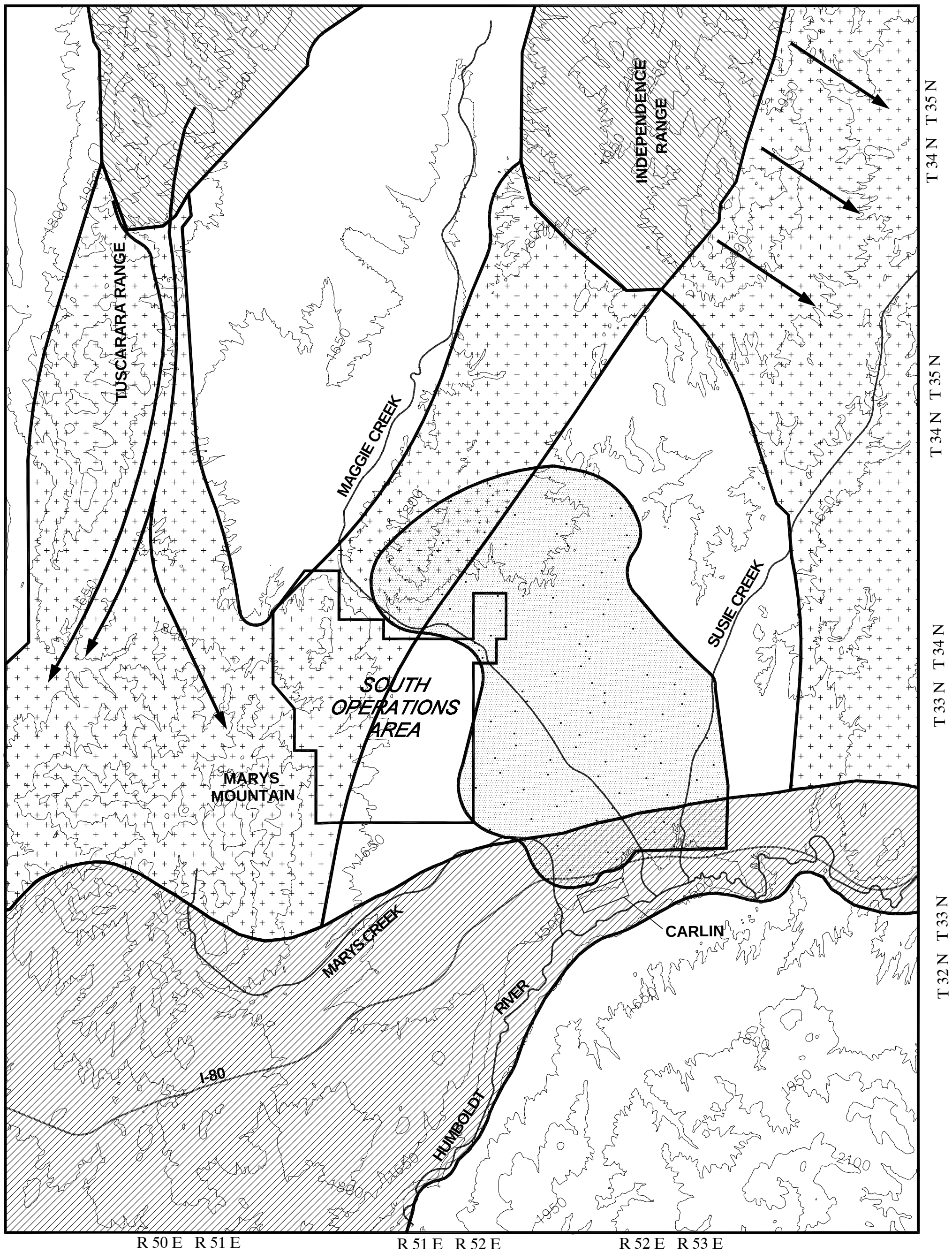
0 1000 2000 3000 4000

Scale (ft)

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-10 WETLANDS AND WATERS OF THE U.S. IN THE SOAPA AREA

MINE AREA: SOUTH AREA	
DATE: 6/6/00	ACAD FILE: Fig3-10.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS



LEGEND

- Mule Deer Migration Routes to Winter Range
- Crucial Mule Deer Winter Range
- Crucial Mule Deer Summer Range
- Mule Deer Transitional Range
- Pronghorn Winter Range
- Contour Interval 150 Meters

N

0 4 8

Scale in Miles

Source: BLM, 1993.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-11
CRUCIAL RANGE
FOR WILDLIFE

MINE AREA: SOUTH AREA	
DATE: 7/20/00	ACAD FILE: Fig3-11.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

064, 071 and 073 and Unit Group 067-068. Unit Group 067-068 comprises the west slope of the South Tuscarora Range in the Boulder Valley area and includes the SOAPA project site. The population of this herd continues to increase following the 1992-1993 winter die-off. Good fawn production, combined with favorable winter conditions have contributed to this trend. However, the lack of winter range will eventually limit these herds. The current (April 2000) population estimate for the 067-068 Unit Group is 550 antelope. The eastern portion of the project area supports pronghorn winter range.

Antelope distribution extends from the North Tuscarora Range to Interstate 80 near Dunphy. Antelope in Unit Group 061-073 winter in the vicinity of the project area. This population is estimated to be 1,300 animals. Antelope distribution in Unit Group 061-073 extends as far north as Merritt Mountain, as far east as Stagg Mountain, and as far south as the project area. The winter range for this herd is considered crucial and is the limiting factor for this herd.

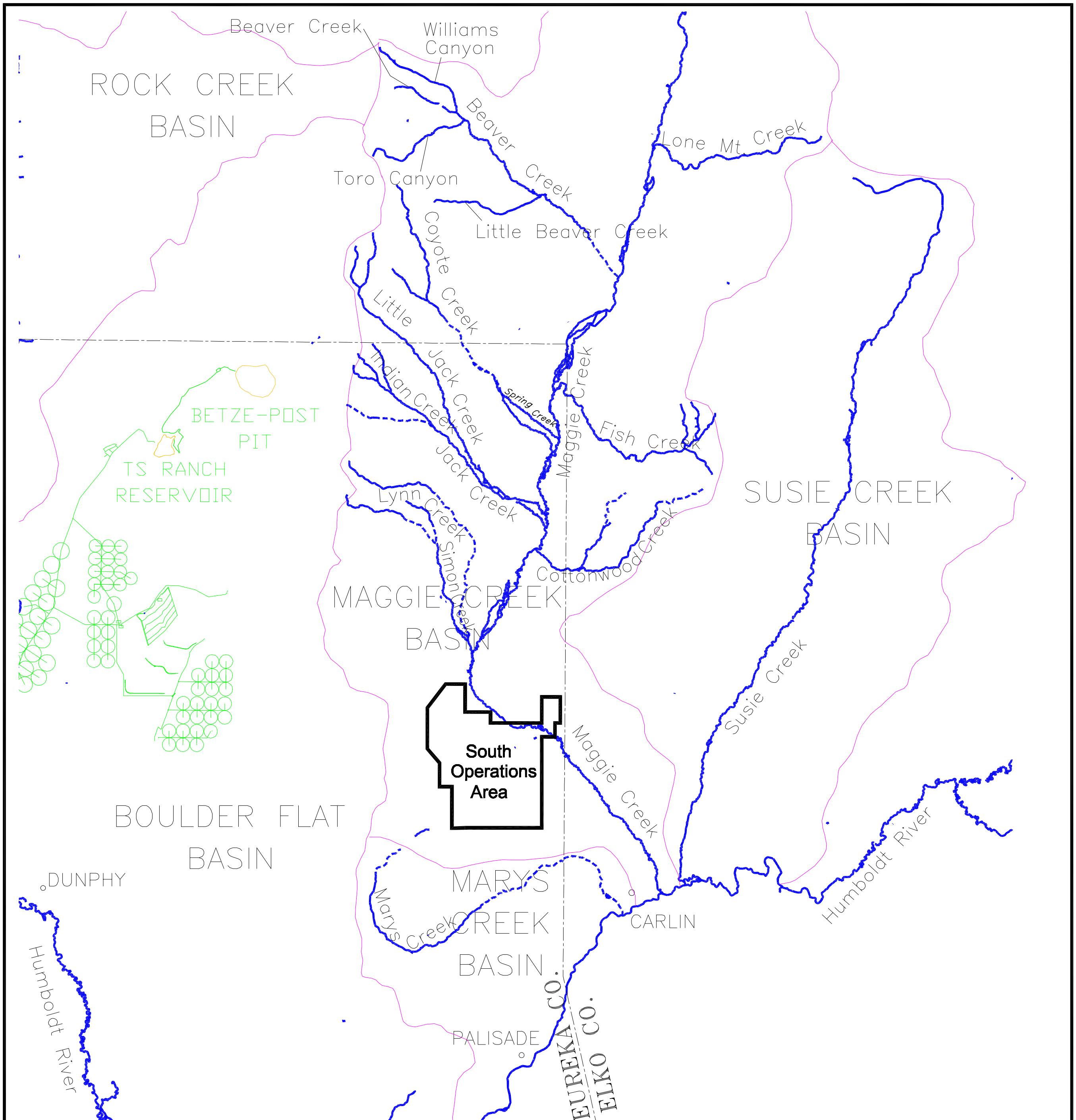
The closest population of California bighorn sheep to the SOAPA area is the Rock Creek herd, estimated at 65 animals. This population is distributed from lower Rock Creek Gorge to Willow Creek reservoir on the west side of the Tuscarora Range. The southwestern portion of their range are scattered throughout Kelly Creek, Jakes Creek, and the Owyhee Bluffs. Sheep have been observed in the South Fork of the Little Humboldt River drainage. There have been no reported observations of sheep within the South Operations Area.

Other species of importance within the project area include sage grouse, **chukar,** golden eagles, red-tailed hawks, ferruginous hawks, Swainson’s hawks, prairie falcons, American kestrels, northern goshawk, northern harrier, and great horned and long-eared owls. In addition, non-game birds, waterfowl, shorebirds, reptiles, and amphibians also occur within or near the project area. These species are expected to occur only within areas of suitable habitat. However, specific ranges have not been identified.

AQUATIC HABITAT AND FISHERIES

Aquatic community structure and composition are generally the same as was discussed in the original EIS (BLM, 1993). However, new fisheries studies have been conducted within the project area since the EIS was prepared. Sponsors included Barrick Goldstrike Mines, Inc. (BIO/WEST, 1994), Newmont (AATA, 1997), and the Nevada Division of Wildlife (1996, 1997, 1999). Streams surveyed during BioWest’s study included Beaver Creek, Little Beaver Creek, Toro Canyon Creek, three tributaries to Toro Canyon Creek, Williams Canyon Creek, and Barber Creek. Streams surveyed during AATA’s study included Lynn, Simon, Fish, Jack, Little Jack, Spring, Coyote, Beaver, Little Beaver, Maggie, Cottonwood, and Susie creeks. Streams surveyed by NDOW included Little Jack Creek, Maggie Creek, and Coyote Creek in 1996, 1997, and 1999, respectively. These streams and aquatic habitat areas are shown in **Figure 3-12**, and together they constitute the study area for aquatics.

Fish species found during these studies included Lahontan speckled dace, Lahontan redside shiner, Tahoe sucker, and Lahontan cutthroat trout. Refer to the following section of this document for a detailed description of Lahontan cutthroat trout and aquatic habitats within the Maggie Creek Basin. Besides



LEGEND

- Basin Boundaries
- Conveyance/Irrigation
- Streams
- Intermittent Streams

N

0 5 10

Scale in Miles

Source: BLM, 2000b

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-12
AQUATIC HABITAT AREAS

MINE AREA: SOUTH AREA	
DATE: 8/1/00	ACAD FILE: Fig3-12.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

Lahontan cutthroat trout, no trout species were found in any of the surveyed streams in either the 1994 or 1997 surveys. Brook trout were found in Spring Creek in 1992 (JBR, 1992g), but none were found during the 1997 survey of Spring Creek.

THREATENED, ENDANGERED, CANDIDATE AND SENSITIVE SPECIES

This section discusses special status wildlife species that include those listed as threatened or endangered under the federal Endangered Species Act of 1973 as amended; species **under review** for **possible** listing (candidate); and other species of concern identified either by the USFWS, NDOW, or BLM as sensitive, unique, or rare which have the potential for occurrence within the project area. **Table 3-26** includes Threatened, Endangered, Candidate, and Sensitive species of plants and animals on lands administered by Elko BLM that could potentially occur in the SOAPA study area as of December 15, 1999. Nevada BLM policy is to provide BLM sensitive species and State of Nevada Listed Species with the same level of protection as is provided for candidate species as stated in the BLM Manual 6840.06C.

The USFWS (1997) has designated the Lahontan cutthroat trout and bald eagle as threatened species and the spotted frog as a candidate species under the Endangered Species Act. These three species have the potential to occur on or in the vicinity of the project area. **Table 3-26** lists the USFWS-listed Threatened, Endangered, and Candidate species. Nevada-listed species and BLM's Sensitive species potentially occurring in the SOAPA area are also contained in this table.

Bald Eagle (Threatened)

The bald eagle occurs in Northern Nevada as a winter **resident (NDOW, 2000a)**. During the winter, eagles usually occur in areas near bodies of water which remain free or partially free of ice. Bald eagles usually winter near unfrozen bodies of water because fish and waterfowl are common prey and riparian areas often have cottonwood trees used as perches.

No bald eagles were observed in the South Operations Area in 1991-92, although the species may occur in the area. Wintering bald eagles were observed in 1992 along the Humboldt River at five locations between Elko and Battle Mountain (NDOW, 1992).

Winter counts have reported bald eagles near Wilson and Wildhorse Reservoirs, which are located north of the South Operations Area. No records of nests or communal roosts in or near the South Operations Area are known.

Lahontan Cutthroat Trout (Threatened)

Historically, Lahontan cutthroat trout occupied streams throughout the Humboldt River drainage, including the mainstem of the Humboldt River. Habitat degradation, water development projects, and introduction of non-native trout that hybridize and compete with Lahontan cutthroat trout have eliminated this species over much of its former range.

Lahontan cutthroat trout has been found to inhabit 447 miles of streams in Nevada with stream-dwelling populations estimated at 110,000 fish (USFWS, 1995). Within the Humboldt River Basin, Lahontan cutthroat trout occurs in 83 to 93 streams and

TABLE 3-26
THREATENED, ENDANGERED, CANDIDATE, AND SENSITIVE SPECIES OF PLANTS AND ANIMALS POTENTIALLY OCCURRING IN THE SOAPA STUDY AREA[1] (AS OF DECEMBER 1999)

Common Name	Scientific Name	Status	Probability of Occurrence in Study Area
Mammals			
Spotted bat	*Euderma maculatum*	Nevada-Listed[2,3]	Low
Small-footed myotis	*Myotis ciliolabrum*	BLM-Sensitive	Possible
Long-eared myotis	*Myotis evotis*	BLM-Sensitive	Likely
Fringed myotis	*Myotis thysanodes*	BLM-Sensitive	Possible
Long-legged myotis	*Myotis volans*	BLM-Sensitive	Low
Pale Townsend’s big-eared bat	*Plecotus townsendii pallescens*	BLM-Sensitive	Likely
Pacific Townsend’s big-eared bat	*Plecotus townsendi townsendii*	BLM-Sensitive	Likely
Preble’s shrew	*Sorex preblei*	BLM-Sensitive	Possible
Birds			
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Likely
White-faced ibis	*Plegadis chihi*	Nevada-Listed	Likely
Northern Goshawk	*Accipiter gentilis*	Nevada-Listed	Low
Ferruginous Hawk	*Buteo regalis*	Nevada-Listed	Likely
Burrowing Owl	*Athene Cunicularia*	Nevada-Listed	Possible
Golden eagle	*Aquila chrysaetos*	Nevada-Listed	**Present**
Swainson’s hawk	*Buteo swainsoni*	Nevada-Listed	Low
Osprey	*Pandion haliatus*	Nevada-Listed	Low
Western sage grouse	*Centrocercus urophasianus*	BLM-Sensitive	Present
Fish			
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	Threatened	Likely
Mollusks			
California Floater	*Anodonta californiensis*	BLM-Sensitive	Likely
Springsnails	*Pyrgulopsis sp.*	BLM-Sensitive	Present
Butterfly			
Nevada Viceroy	*Limenitus archippus lahontani*	BLM-Sensitive	Likely
Amphibians			
Columbia Spotted frog	*Rana luteiventris*	Candidate	Likely
Plants			
Lewis Buckwheat	*Eriogonum lewisii*	BLM-Sensitive and Nevada-Listed	Low

Source: U.S. Fish and Wildlife Service, 1997; BLM, 1997; NDOW, 1996b.

[1] Based on input provided by BLM, Nevada Division of Wildlife, and U.S. Fish and Wildlife Service in BLM Instruction Memorandum No. NV-98-013 (February 27, 1998). BLM Elko Field Office input provided for BLM Instruction Memorandum No. NV-98-013 was entitled “Former Candidate Category 2 Species On Or Suspected On Elko District - BLM Lands Recommended As BLM Sensitive Species As Of 5/96.” Information per October 25, 1999, Federal Register; peregrine falcon is no longer listed as a threatened species and, in effect, is no longer “listed.”

[2] Per wording for Table IIa. In BLM Instruction Memorandum No. NV-98-013 for Nevada State Protected Animals that Meet BLM’s 6840 Policy Definition: Species of animals occurring on BLM-managed lands in Nevada that are: (1) “protected” under authority of Nevada Administrative Codes 501.100 - 503.104; (2) also have been determined to meet BLM’s policy definition of “listing by a State in a category implying potential endangerment or extinction”; and (3) are not already included as BLM Special Status Species under federally listed, proposed, or candidate species.

[3] Nevada BLM policy is to provide these species with the same level of protection as is provided for candidate species in BLM Manual 6840.06C.

approximately 318 miles of riverine habitat. This accounts for approximately 14 percent of the historical habitat. Currently, the Humboldt River basin supports the greatest number of fluvial Lahontan cutthroat trout populations native to the Lahontan basin (USFWS, 1995). Populations of Lahontan cutthroat trout in the Maggie Creek subbasin have declined markedly since the turn of the century. Most of Maggie Creek (including all of Maggie Creek within the South Operations Area Project mitigation area) is in an upward trend. Habitat conditions are no longer as confining to Lahontan cutthroat trout as in years past (Evans, 2000). Although large number of other salmonids were stocked throughout streams in the Tuscarora Mountains in the early- to mid-1900s, nonnative trout have apparently been unable to persist in these streams over time.

The Maggie Creek subbasin has a number of creeks that either support or have the potential to support Lahontan cutthroat trout; all within the upper portion of the Maggie Creek subbasin. Several fish inventories have been conducted within these creeks (BLM, 1994; JBR, 1992g; BIO/WEST, 1994; AATA, 1997; NDOW, 1996, 1997, 1999). Studies indicate that Lahontan cutthroat trout occur in 9 of the 12 streams with potential to support trout in the Maggie Creek subbasin (BLM, 1994). These streams include Maggie, Little Jack, Jack, Beaver, Toro Canyon, Coyote, Little Beaver, Williams Canyon, and Lone Mountain creeks.

Three of the main tributary streams containing Lahontan cutthroat trout (Coyote, Little Jack, and Beaver creeks) were found to have fish migration barriers (perched culverts) at the Maggie Creek Road which **inhibit, but do not totally** prevent, movement of populations to the various streams. NDOW has observed very large Lahontan cutthroat trout individuals at the lowest sampling stations in Beaver and Coyote creeks, which they interpret to mean that these large sized fish may be able to negotiate these barriers during the spring spawning migration (NDOW, 2000). Lack of perennial stream flow in the lower reaches of these drainages also limits potential for fish in Maggie Creek to access tributary streams. As a result, individual tributary stream populations **can be somewhat** isolated from the main stem of Maggie Creek and from each other. Therefore, the entire life history of the reproductive populations of Lahontan cutthroat trout must be met in the upper canyons (above the canyon mouths) where there is continuous flow and summer conditions were found to be well below upper incipient lethal temperatures (AATA, 1997). Previous documentation of Lahontan cutthroat trout in lower reaches of these streams (including all of Maggie Creek) are thought to be outwash victims that are essentially lost from reproductive populations occurring in the upper canyons **(AATA, 1997)**. **However, the LCT Recovery Plan (USFWS, 1995) characterized the Maggie Creek sub-basin as having metapopulation potential in all streams in the area during normal and above-normal water years.**

Drainages within the general project area containing Lahontan cutthroat trout have been subjected to grazing pressure of varying intensities for approximately 130 years. Historic impacts to Lahontan cutthroat trout habitats have been previously documented (BLM, 1993). Since the MCWRP was implemented in 1993, improvement of riparian habitat including streams occupied by Lahontan cutthroat trout has been excellent (BLM, 1997b; BLM, 1999). Refer to discussion under Affected Area for Riparian Areas earlier in this chapter for more information on the MCWRP. Streams which were once characterized by eroding streambanks and a wide, shallow channel profile now support healthy functioning riparian zones and stable, well vegetated streambanks. **Appendix A** documents the success of implementation of the MCWRP. It also contains "before and after" photographs of Maggie and Coyote creeks. Where biological criteria have been established for the reintroduction of grazing, standards have been met and grazing has been applied on a prescription basis since 1997. Lahontan cutthroat trout is currently abundant in both Little Jack and Coyote creeks. New populations were also discovered in Jack Creek in 1997 **and 1998** and Lone Mountain Creek in 2000.

Columbia Spotted Frog (Candidate)

This species inhabits areas around permanent sources of water such as marshy edges of ponds or lakes, in algae-grown overflow pools or streams, or near springs with emergent vegetation during the breeding season (Spahr, 1991). They move considerable distances from water after breeding, often frequenting mixed conifer and subalpine forests, grasslands, and brushlands (Spahr, 1991).

The spotted frog was observed within the study area during 1992 baseline surveys (JBR, 1992g). Specimens were collected along Coyote and Little Jack Creeks. Although no spotted frogs were collected in Maggie Creek, potential habitat is present, and their occurrence in this drainage is possible.

Spotted Bat

This species has not been reported for northeastern Nevada but is typically found in rough desert terrain with limestone or sandstone cliffs (Zevaloff, 1988; Watkins, 1977). Little is known about the biology of this species, but the limited literature available suggests that they prefer crevices in rocky, cliff habitat for roost sites (Leonard and Fenton, 1983; Easterla, 1973), especially where rocky cliffs occur in proximity to riparian areas (Findley et al., 1975). Although areas of rock outcrop near water within the project area may represent suitable habitat for this species, no observations of this species have been recorded over the course of baseline surveys.

Small-footed Myotis

The small-footed myotis is a bat widely distributed as a year-round resident of the western United States, including Nevada. It uses a variety of habitats in rocky and canyonland areas for roosting and foraging. Day and maternity roosts have been found in cliffs, boulders, and on talus slopes. Night and hibernation roosts have been found in small caves and abandoned mine adits.

Areas of rock outcrops, mine adits, and buildings in the project area could potentially provide suitable roost and/or maternity sites for the small-footed myotis. One small-footed myotis was captured in T35N, R50E, Section 9 during a bat survey in 1996 for Newmont's Lantern Mine Expansion Project. This location is approximately 10 miles northwest of the SOAPA project area (BLM, 1993).

Long-eared Myotis

The long-eared myotis bat is widespread throughout most of the western United States and is found at elevations ranging from sea level to 8,500 feet (Manning and Knox Jones, 1989). Preferred habitat consists of stream or riparian areas adjacent to forest edges. This species roosts in buildings and under the bark of trees, but caves and abandoned mines are also used as temporary roosts between foraging flights at night (Barbour and Davis, 1969).

A total of three long-eared myotis was captured at a stock pond on Soap Creek within the study area during 1992. Although no other long-eared myotis were collected during the effort, it was concluded that the species was common within the study area.

Fringed Myotis

The fringed myotis bat is a widely distributed species that may be found in northeastern Nevada. This species is generally found at middle elevations in grasslands and woodlands, and on occasion has been observed in higher elevations in forested habitats (BLM, 1993). Caves, mines, or buildings are used as roost sites. Day roosts may occasionally be located in tree cavities.

No documented occurrences of the fringed myotis in Elko County have been reported. No specimens were captured or observed during surveys conducted in the South Operations study area during 1992 (BLM, 1993).

Long-legged Myotis

Long-legged myotis bats have been found in a variety of habitats, but prefer higher elevation coniferous forests (Zeveloff, 1988). This species roosts in buildings, under loose tree bark, and in rock crevices and fissures in the ground. Caves and abandoned mines are used for temporary roosting between foraging sites at night (Barbour and Davis, 1969).

Suitable habitat for this species exists within the higher elevation portions of the baseline study areas, but it was not recorded by surveys in the study area (BLM, 1993).

Townsend's Big-Eared Bat (Pale & Pacific)

The pale Townsend's big-eared bat is one of two subspecies of the Townsend's (or western) big-eared bat that may occur in northeastern Nevada. Available information suggested the Pacific western big-eared bat occurs in northeastern Nevada, and the pale Townsend's big-eared bat has also been found there by Bradley (1995).

This bat uses a variety of habitats including pinyon-juniper, shrub-steppe grasslands, deciduous forest, and mixed coniferous forests at elevations ranging from sea level to 10,000 feet (BLM, 1993). However, because it forages over water, it is most abundant in mesic habitats. This species roosts primarily in caves, mine shafts, or adits.

Townsend's big-eared bats were observed within the study area in abandoned mine adits in the upper Lynn Creek drainage (BLM, 1993). Two males in active breeding condition were captured in mine adits and bats suspected to be big-eared bats were observed flying over springs and ponds near the abandoned mine adits (BLM, 1993). However, the ponds washed out in the spring runoff in 1993. Therefore, it is unknown whether the bats still inhabit the adits along Lynn Creek. Although the Humboldt River was not surveyed, it is likely that the area is used by foraging Townsend's big-eared bats (BLM, 1993).

Preble's Shrew

Few site-specific data are available for the Preble's shrew, although it has been reported in the northern portion of the Great Basin. Suitable habitat ranges among sagebrush, grasslands, openings in subalpine forest, and alpine tundra (BLM, 1993). This small mammal also is believed to occupy wetland or marshy habitats containing adequate emergent and woody plant species (BLM, 1993). The Preble's shrew has been documented in northern Elko County (BLM, 2000b). Currently, it is unknown whether this species occurs in the study area; however, suitable habitat occurs east of the Tuscarora Mountains (BLM 1996). The Preble's shrew also may occur along the Humboldt River drainage, since suitable habitat may be present along the river corridor and associated floodplains.

Northern Goshawk

In the Independence Mountains of Nevada, studies have determined that goshawks inhabit the shrub steppe habitat type and prefer small widely scattered aspen groves for nesting (Younk and Bechard, 1994). These stands are generally older and often on north- or east-facing slopes. Furthermore, nest sites preferred by the birds are on minor slopes (four to 39 percent) within 100 yards of water such as springs and streams.

Goshawks prey on a variety of species, particularly small mammals and birds in timber areas. Foraging has been documented to occur in heavy canopied forests with open understories. Within the Independence Mountains, goshawks have been observed foraging in aspen stands, in small sagebrush inclusions within aspen stands, along aspen stand ecotones, and in open sagebrush areas (Younk and Bechard, 1994).

Goshawks may nest within the juniper habitats of the project area, however, nesting habitat is limited within the area. They also may forage within the juniper and sagebrush habitats of the area.

Ferruginous Hawk

The ferruginous hawk, the largest North American buteo, is a year-round resident (at very low densities during the winter) of northern Nevada (Evans, 1983). It prefers open habitats, including grasslands, shrublands, steppe-desert areas, and the edges of pinyon-juniper woodlands. In contrast, they consistently avoid extensively forested areas (including the interior pinyon-juniper woodlands) and mountainous areas with steep-sided canyons and cliffs.

Ferruginous hawks are probably the most adaptable nesters of any raptors (Call, 1978). They will nest in trees when possible, preferably the largest trees available. However, when trees are unavailable they will nest on rocky outcrops, low cliffs, buttes, cutbanks, and a variety of human-made structures. Ferruginous hawk nests have been observed on metal transmission line towers, wooden power poles, haystacks, chimneys, windmills, abandoned buildings, and spoil piles at mine sites.

Ferruginous hawks are known to concentrate in the wet meadow along upper Maggie Creek during the late summer and early fall. This appears to be a staging area where the birds feed on large populations of small mammals prior to the birds migration.

Burrowing Owl

The western burrowing owl is primarily a summer breeder in northeastern Nevada that migrates south for the winter. It is a small, ground-nesting owl that nests in burrows excavated by rodents, badgers, or foxes. This owl generally selects burrows in open, level sites with low or desert vegetation. In addition, elevated perches for observation, such as mounds, fence posts, or utility poles characterize good habitat for the burrowing owl (Johnsgard, 1986).

Burrowing owls have been observed by BLM personnel nesting throughout the area between the South Operations Area and the Carlin Mine (as well as Welches Canyon and the eastern side of Richmond Mountain).

White-Faced Ibis

The white-faced ibis (a shore bird) feeds in wet meadows and shallow water found along streams and lakes. They nest in areas with extensive water and build their nests in heavy emergent marsh vegetation (Dinsmore, 1983). Birds feed on frogs, grasshoppers, crayfish, and other invertebrates.

This species was observed in the study area along the Humboldt River and near the confluence of Simon and Maggie Creeks (JBR, 1992g). A total of 15 ibis was observed at the Maggie Creek site. Although no young were observed, it is possible that nesting could occur at this location (BLM, 1993). Approximately 950 acres of wet meadows along Maggie, Coyote, and Little Jack Creeks were considered as potential nesting and/or foraging habitat for this species within the study area (BLM, 1993).

Golden Eagle

Golden eagles most often nest on cliffs and sometimes in trees. Golden eagles forage widely over open habitats, including grasslands, sagebrush, farmlands, and tundra. Suitable mixes of cliffs and sagebrush can support high concentrations of golden eagles, especially where there is a large rabbit supply. Golden eagles prey mainly upon rodents, hares, rabbits, ground squirrels, marmots, and prairie dogs, and in winter, on carrion (Kingery, 1998). Golden eagles are present within the project area.

Swainson’s Hawk

Swainson’s hawks inhabit prairies, plains, deserts, large mountain valleys, savannahs, open pine-oak woodlands, and cultivated lands with scattered trees. They nest in isolated trees, in shrubs and trees along wetlands and drainages, in windbreaks in fields and around farmsteads, in giant cactus, or on the crossbars of telephone poles. They occasionally nest on the ground, on low cliffs, on rocky pinnacles, or on cutbanks. They may build nests up to 100 feet above ground in cottonwoods, or lower in willows or other shrubs. May repair and use the same nest year after year. They hunt primarily from perches such as fence posts or low trees and from a vantage point on the ground. Their diet consists of small mammals, birds, fishes, salamanders, frogs, snakes, and insects. Swainson’s hawks are likely to be present within the project area.

Osprey

Ospreys are migratory and spend their winters in Mexico and Central and South America. Ospreys return to Alaska in late April. The nest is situated near water, atop trees, posts, and rock pinnacles, or even on the ground. The osprey's diet is mainly fish. They are not particular about the species of fish they catch, but they can only catch fish swimming within 3 feet (1 m) of the water's surface. They rarely take fish over 16 inches (40 cm) long. Ospreys occasionally capture small mammals, birds, amphibians, and reptiles. Ospreys have **been documented as close as Dunphy, along the Humboldt River (NDOW, 2000a).**

Western Sage Grouse

Sage grouse are year-long residents of the SOAPA area that are normally associated with sagebrush habitats in rolling hills and benches along drainages. Their breeding sites are called leks and six leks have been identified and named in the study area: Upper Fish Creek Bench, Lower Fish Creek Bench, Richmond Mountains, South Marys Mountain, South Jack Creek, and Palisade Complex. Mesic habitats are especially important to sage grouse in summer and autumn, as upland habitats in the study area do not provide the quality and quantity of food for growth of young and feather molting. Low elevation sagebrush stands on benches or south or west-facing slopes may be relatively more important, particularly during severe winters.

California Floater

The California floater is a freshwater mussel historically found in unpolluted lakes and streams in western North America from British Columbia to Mexico (Hulen, 1988). This species can reproduce only in association with certain fish that serve as hosts for the mussel's parasitic life stage. At present, the host species are not known. When the host fish or fishes are eliminated or greatly reduced in numbers, mussel populations decline and eventually disappear (Bequaert and Miller, 1973). According to Call and Gilbert (1893), California floaters were once abundant in the Humboldt River. Hamlin (BLM, 1993) reported its presence in the North Fork of the Humboldt River. Two live mussel specimens were found and photographed on Maggie Creek in late June and early July of 1993 (Worley, 1993). The mussels were identified as California floaters on the basis of the photographs (McGuire, 1993). One of the mussels was found immediately north of the confluence of the East Fork of Cottonwood Creek, while the second was observed approximately half way between the confluences of Cottonwood and Jack/Little Jack creeks. McGuire (1993) also reported finding old California floater shells in the vicinity of the Maggie Creek Narrows in July of 1993.

Springsnails

Springsnails, a group of mollusks that are found in perennial springs and seeps, are considered important organisms due to their restricted distribution and native origin. Although the taxonomic classification of springsnails below the family level is difficult, most springsnails known from the study area are of the Genus *Pyrgulopsis.* Springsnails have been collected at a limited number of springs and seeps within the SOAPA area (JBR, 1992g).

Based on surveys conducted in 65 springs and seeps in 1992, springsnails were collected at one site in the SOAPA area (BLM, 2000b). *Pyrgulopsis bryantwalheri* was present in Warm Spring which is located near the Humboldt River about three miles south of Carlin. Estimated density at this collection site was 1,000/m^2. Habitat conditions in springs supporting springsnails showed the following characteristics. Springsnails usually were confined to the spring source and a wetted area immediately downstream from the spring.

The springs also exhibited low to moderately high discharges (5 to greater than 30 gpm), stable substrates consisting of gravel, cobble, or boulder, and dense growth of aquatic vegetation such as *Ranunculus aquaticus* or *Nasturtium* (BLM, 2000b). Springsnails often decline in density downstream of stream sources, presumably reflecting their requirement for stable temperature, chemistry, and flow regime (BLM, 2000b).

Nevada Viceroy

The Nevada viceroy butterfly occurs in moist open or shrubby areas such as lake and swamp edges, willow thickets, valley bottoms, wet meadows, and roadsides. Host species include cottonwoods and willows. During the day males stay near host plants to find females. The females lay eggs on the tips of the leaves of the host plants. The caterpillars eat the eggshells after they hatch, then feed on catkins and leaves. Adults feed on aphid honey, carrion, dung, and decaying fungi. Later generations feed on flowers, such as asters, goldenrod, and Canada thistle. There have been confirmed reports of Nevada viceroys in Elko County (Struttmann, 1998).

The Nevada viceroy has been documented within the study area along the Humboldt River and Maggie Creek. This species may potentially occur in the willow habitats along Little Jack and Coyote Creeks.

Lewis Buckwheat

Lewis buckwheat is one of several recently-evolved, closely related species of wild buckwheat that is specific to a particular substrate. It "appears nearly restricted to limestone or other carbonate rock types with a significant silt or other siliceous component, usually where it crops out and forms shallow, rocky residual soils on high, dry, exposed, relatively barren, relatively undisturbed ridge-line knolls and crests on all aspects between 6,470 and 9,720 (1,970-2,960 meters) feet elevation" (Morefield 1996). Common associates of Lewis buckwheat include low sagebrush, black sagebrush, green rabbitbrush, Indian ricegrass, and squirreltail grass.

The known range of the Lewis buckwheat includes the Bull Run, Independence, Tuscarora, and Jarbidge Mountains in Elko and Eureka Counties, Nevada. A total of 33 occurrences are known from this area. Additional potential habitat is thought to occur in northeastern Nevada, and possibly southern Idaho and northwestern Utah (Morefield 1996). No occurrences of Lewis buckwheat are known from the study area. Three occurrences of Lewis buckwheat are known from ridges along the top of Mary's Mountain, approximately one to two miles southwest of the study area. These occurrences range in elevation from approximately 6,960 to 7,270 feet. Several surveys failed to find Lewis buckwheat on other parts of Mary's Mountain, although parts of the range are still considered potential habitat for this species (Morefield 1996).

Based on the types of habitats that Lewis buckwheat is known to occupy, it is unlikely that there are any occurrences of this species in the study area. The study area ranges in elevation from approximately 5,040 to 6,020 feet, entirely below the known lower elevation limit for Lewis buckwheat. The nearby occurrences of Lewis buckwheat are located on upper ridges and saddles on Mary's Mountain, whereas the study area is located on the valley floor and lower slopes below Mary's Mountain. Finally, the lack of known occurrences in an area subject to

reasonably intense resource inventory also suggests that it is very unlikely that there are any undetected occurrences of the Lewis buckwheat in the study area.

LIVESTOCK GRAZING

The study area for grazing is an area roughly 35 miles by 25 miles centered on the South Operations Area Project. Livestock grazing is a major land use within the study area. Twelve livestock grazing allotments comprise the study area for grazing (**Figure 3-13**). Grazing allotments are areas of public and private land used by qualified permittees for livestock grazing. Grazing within an allotment is administered by BLM. Four of the allotments in the area are licensed to one permittee, and the remaining eight allotments are licensed to different permittees. Existing mine area disturbance is fenced to prevent livestock use, and includes a portion of the T Lazy S and Marys Mountain allotment. Information pertinent to each grazing allotment is presented in **Table 3-27.** Range improvements within the area are shown in **Figure 3-13**.

RECREATION

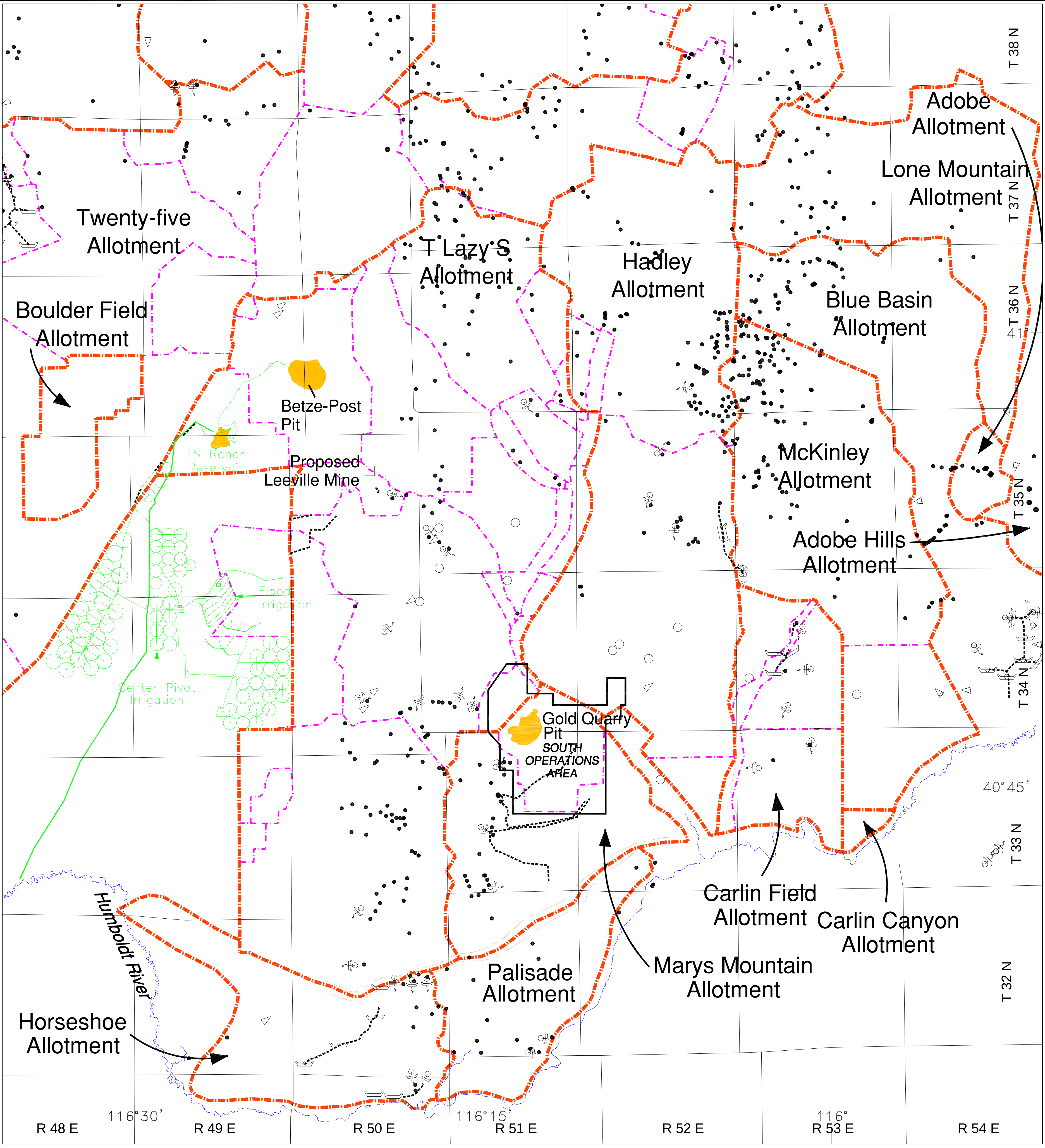
The regional study area for the general description of recreation resources is the public land administered by the BLM Elko Field Office which is in northeastern Nevada. The proposed project area is located in Eureka and Elko counties.

The overall objective for recreation management on public lands managed by the Elko Field Office is to provide a wide range of recreation opportunities. The majority of the Elko RMP area has been designated as “open” for off-highway vehicles. Off-highway vehicles use in the Special Recreation Management Areas and Wilderness Study Areas is “limited” to designated roads and trails. Off-road vehicle use is concentrated near the cities and towns.

There are numerous recreation areas on public lands in the RMP area managed by the BLM, Humboldt-Toiyabe National Forest, the State of Nevada, and the U.S. Fish and Wildlife Service. These areas are described in the original EIS (BLM, 1993). The nearest recreation area is the Carlin Canyon Historical Wayside located about five miles east of Carlin. This interpretive site was completed in 1999 and consists of two shelters with benches and three interpretive panels. Another nearby recreation area is the BLM’s South Fork Canyon Special Recreation Management Area located about 20 miles southeast of the project area.

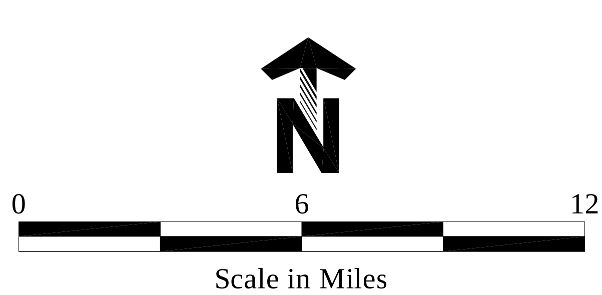
State Recreation Areas

State Recreation Areas include the South Fork State Recreation Area and the Wild Horse State Recreation Area. The South Fork State Recreation Area is 15 miles southeast of Carlin. The Wild Horse State Recreation Area is approximately 70 miles northeast of Carlin. Visitation data to each State Recreation Area is summarized in **Table 3-28.** Visits to state parks and recreation areas decreased in northeast Nevada between 1987 and 1991-92. By 1997, the number of visits had increased to higher levels than the 1987 numbers. Drought conditions in 1985-1992 (BLM, 1993) which could adversely affect water-related recreation activities such as fishing and boating in the reservoirs at South Fork and Wild Horse State Recreation Areas are a reasonable explanation for decreases in visits during those years. The increase in visits since 1992 reflect economic growth and increases in population during the 1990s as described in the section on Social and Economic Resources.



LEGEND

- Allotment Boundary
- Pasture Boundary
- Existing Water Pipeline
- Water Trough
- Stock Pond
- Spring
- Improved Spring
- Stock Well
- Center Pivot Irrigation



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-13
GRAZING ALLOTMENTS AND SELECTED RANGE IMPROVEMENTS

MINE AREA: SOUTH AREA	
DATE: 8/3/00	ACAD FILE: Fig3-13.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

TABLE 3-27
LIVESTOCK GRAZING ALLOTMENTS IN THE STUDY AREA

Allotment	Permittee	Management category [1]	Public land (AUMs) [2]	Percent public land	Predominant range condition [3]	Percent of total land base [4]	Number of animals run	Season of use	Type of operation
Carlin Canyon FFR [5]	Maggie Creek Ranch	C	51	100	mid-seral		34 cattle	May 1 to June 15	commercial cow/calf
Carlin Field	Maggie Creek Ranch	I	2,442	100	UNK[6]		335 cattle	April 1 to Dec 20	commercial cow/calf
McKinley FFR[5]	Maggie Creek Ranch	M	727	100	late seral	30 [7]	91 cattle	April 1 to Nov 29	commercial cow/calf
Hadley	Maggie Creek Ranch	I	4,276	49	early to mid-seral		1,119 cattle	April 1 to Dec 20	commercial cow/calf
			206	100 (FFR)			202 cattle	year long	
Horseshoe	Zeda, Inc. Horseshoe Ranch	I	1,489	36-46	mid-seral	25	595 cattle	March 10 to Sep 30	commercial cow/calf
			140	100 (FFR)			200 cattle	year long	
Marys Mountain	Elko Land & Livestock	C	1,408	51	mid-seral	45	324 cattle	Feb 15 to Oct 31	commercial cow/calf
Palisade	Palisade Ranch	C	1,33**6**	47	mid-seral	75	**351** cattle	April **1** to **Dec 31**	commercial cow/calf
T Lazy S (TS)	Elko Land & Livestock	I	11,797[8]	44	early to mid-seral	19	2,718 cattle;	Feb 15 to Nov 30	commercial cow/calf
			202	100 (FFR)			350 cattle	year long	
Blue Basin	Heguy Ranches	NA	4,265	96	NA	NA	584 cattle 9 horses	Apr 1 to Nov 15	commercial cow/calf
Lone Mountain	Garrett Family	NA	7,202	64	NA	NA	1,546 cattle; 2,000 cattle; 1,000 cattle	4/15-7/15 7/15-9/30 10/1-11/15	commercial cow/calf
Adobe	Bruce Miller	NA	526	86	NA	NA	221 cattle	Apr 16 to Oct 15	commercial cow/calf
Adobe Hills	Samuel Layton	NA	2,208	61	NA	NA	696 cattle 10 horses	Apr 1 to Oct 30	commercial cow/calf

Source: BLM, 1993; BLM, 2000b.

1 Management category definitions:
I = Improve the existing condition of the allotment.
C = Manage in a custodial fashion to prevent deterioration of current conditions.
M = To maintain or improve range conditions.

2 An AUM (animal unit month) is the amount of forage required to sustain one cow and calf for a 1-month period.

3 Seral stage describes native range condition. Early, mid, and late seral stage equate to poor, fair, and good range condition, respectively.

4 Percent of the permittees' total deeded and leased land base that is accounted for by the allotment.

5 FFR = fenced federal range.

6 UNK = unknown

7 Carlin Field, Carlin Canyon and Hadley allotments are used as one unit by the permittee, and their combined acreage constitutes approximately 30 percent of the permittees' total land base.

8 1,202 AUMs have been suspended due to wild fires that occurred in 1999. This figure (11,797) does not reflect this suspension.

TABLE 3-28
ANNUAL VISITS TO STATE RECREATION AREAS, 1987 - 1997

	1987		1992		1997	
State Recreation Area	Visits	Percent Change	Visits	Percent Change	Visits	Percent Change
South Fork	na	-	88,466	na	100,668	13.8
Wild Horse	14,912	-	13,162	-11.7	21,696	64.8

Nevada Statewide Comprehensive Outdoor Recreation Plan

The 1987 Statewide Comprehensive Outdoor Recreation Plan published by the Parks Division of the Nevada Department of Conservation and Natural Resources projects supply and demand for recreational facilities in Elko County for the years 1990, 1995 and 2000. The Statewide Comprehensive Outdoor Recreation Plan indicated that supply exceeded demand for tent camping sites, picnic tables and swimming. A moderate increase in baseball and softball fields, golf courses and tennis courts would be required by the year 2000. The demand for fishing, biking trails, crosscountry ski trail and hiking/backpacking trails exceeded the supply for all years. The projected supply and demand were unchanged in the most recent Statewide Comprehensive Outdoor Recreation Plan completed in 1992.

Project Area Recreation

Recreation activities do not occur in the project area, which consists of historic and active mining operations. Recreational activities on public lands adjacent to the project area consist of hunting and off-road vehicle use. The area is hunted primarily for deer, antelope and upland game birds. Mule deer are the most abundant big game species in the area. Upland game birds include sage grouse, chukar, Hungarian partridge and mourning dove. Hunting on public lands within and adjacent to the South Operations Area has been adversely impacted from past and existing permitted mining operations, which have displaced wildlife from disturbed areas. Consequently, hunting is no longer a major recreational use of these lands.

A watershed restoration project was developed through a cooperative effort among Newmont, BLM, and Elko Land and Livestock Company as mitigation for the 1993 Newmont Mine expansion along Maggie Creek. When the Maggie Creek Conservation Easement is finalized, it would provide access to the private lands along Maggie Creek for research and limited low-impact recreational activities. Public access would be allowed after the Riparian Exclusion and Riparian Restoration Zones have had an adequate period of time to recover from grazing impacts. Public use would be limited to daylight hours, and would consist of light-use activities such as hiking and fishing. Motor vehicles, bicycles, and campfires would be prohibited. Horses, dogs, and hunting would be allowed on a TS Ranch-issued permit basis.

VISUAL RESOURCES

The study area for visual resources is an area roughly 20 by 30 miles centered roughly 5 miles northwest of Carlin, Nevada. The landscape of the study area is characterized by broad, open vistas with scattered mountain ranges. The project area is located on gently rolling terrain east of the Tuscarora Mountains, which rise abruptly to over 7,500 feet. The broad, flat valley bottoms of Maggie and Susie creeks lie to the east of the South Operations Area. The landscape was described in detail in the original EIS (BLM, 1993).

The South Operations Area facilities create moderate contrasts to the characteristic landscape with horizontal lines, smooth surfaced blocky and pyramidal forms, and lighter colors from disturbed soil and rock. When weather conditions are calm, black smoke from diesel-powered equipment is often visible above the mine site. During cooler weather, steam plumes may be seen rising from the roaster plant and the cooling towers. Visibility is greatest in the morning when the project facilities are front-lighted.

The viewshed for the project is bounded on the west by the Tuscarora Mountains and to the north by Schroeder Mountain and the hills extending east of Maggie Creek. However, the project has a more extensive viewshed to the south and southeast, as shown in **Figure 3-14**.

The project site is visible to motorists from three locations along Interstate 80. Two of these locations are in the vicinity of the Carlin East interchange and the other is just east of the Carlin West interchange. Motorists near the Carlin East interchange can see the South Operations Area for approximately 60 seconds when driving at 75 miles per hour. Views of the project site are most noticeable to westbound travelers. Other visual features within the Interstate 80 corridor include urban development (e.g., buildings, signs, parking areas, and commercial facilities), highway and railroad cuts and embankments, and powerlines.

The project site is not directly visible from the town of Carlin due to a low ridge north of town. Visibility of the project site is limited along State Highway 766 for a distance of about 3.5 miles northwest of Carlin due to a low ridge. Under certain meteorological conditions, project lighting can cause a glow in the night sky that is visible from Carlin.

The BLM has developed the Visual Resource Management system to classify visual resources based on scenic quality, visual sensitivity, and visual distance zones. Most lands in the study area are assigned to Class III and IV (**Figure 3-15**). Of the four Visual Resource Management classes, Class IV allows the greatest modification of the landscape by disturbance or development (BLM, 1986).

Most of the project area is located in Class IV lands. Class III lands which include the Tuscarora Mountains are located immediately west of the project area. A 3-mile-wide low- visibility corridor along Interstate 80 has been designated and is managed as Class II, reflecting the visual sensitivity of a relatively high number of motorists. Class objectives are:

Class II: The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the character landscape.

Class III: The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant features of the characteristic landscape.

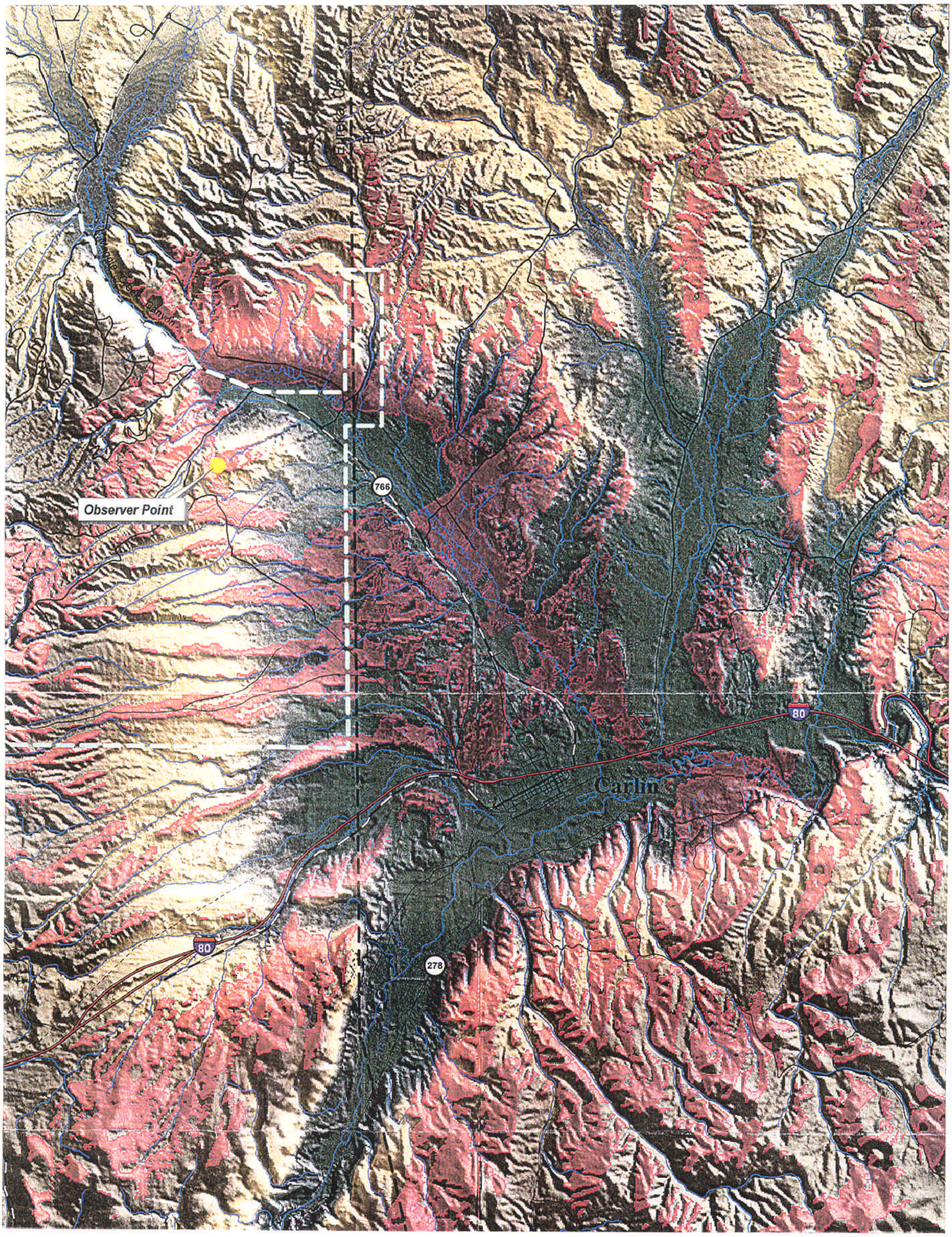
Class IV: The objective of this class is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. The impacts of these activities should be minimized through careful location, minimal disturbance and repetition of the basic elements.

Class Boundaries Visual resource contrast ratings (BLM, 1986) were established for the existing South Operations Area Project. These ratings characterize the visual quality of the landscape based on basic design elements of form, line, color, and texture and allow visual contrast ratings to be made between the existing environment and the proposed action. Visual contrast ratings are based on the premise that the visual quality of a landscape depends on the visual contrast created between a project and the existing landscape.

Key observation points (KOPs) were used for evaluating visual contrasts. Factors considered in selecting KOPs included angle of observation, number of viewers, duration of view, relative apparent size of the project, season of use, and lighting conditions (BLM, 1986). Two of the three KOPs were established in 1993 (BLM, 1993) and one new KOP was established in 1997. KOPs were selected to represent locations on roads approaching the project site from which a person may be expected to view project features. Three KOPs were evaluated (two were existing and one was new). Locations of the KOPs are shown in **Figure 3-15**. **Appendix A** contains Visual Contrast Rating worksheets for KOPs 1, 4, and 6. KOPs 2, 3, and 5 were not analyzed for the SOAPA project. KOPs 2 and 5 are north of Schroeder Mountain which prevents any views of the proposed disturbed areas, and KOP 3 has difficult access to its location high on Marys Mountain and is not considered representative for very many viewers.

KOP 1 is located along Interstate 80, a Class II managed area, and represents the view seen by travelers through the region. This KOP is slightly lower than the project site and is approximately 5 miles away. Visibility is greatest during the morning hours when the project site is front-lighted and smoke from diesel-powered equipment is more likely. KOP 1 is located at a point where westbound travelers are beginning a view of approximately 60 seconds when traveling at 75 miles per hour. Visual contrasts are moderate when the project site is front-lighted or when diesel smoke is visible. The characteristic landscape is flat to rolling, with angular forms presented by urban development in the foreground-middleground zone and existing mine facilities at the boundary between middleground and the background zone. Horizontal and weak diagonal lines are stronger in the afternoon due to lighting conditions. Exposed soil colors are chalky buff and reddish tan, with vegetation colors ranging from gray-green in the foreground to gray, tan, buff, and yellowish tan in the background. Textures are generally subtle.

KOP 4 is located west of the junction of the former Carlin landfill access road with State



LEGEND

- Project Boundary
- County Boundary
- Interstate Highway
- Primary Road
- Secondary Road
- Existing Pipeline
- River/Stream
- Areas Seen From Observer Point

NORTH

1 0 1 2 Miles

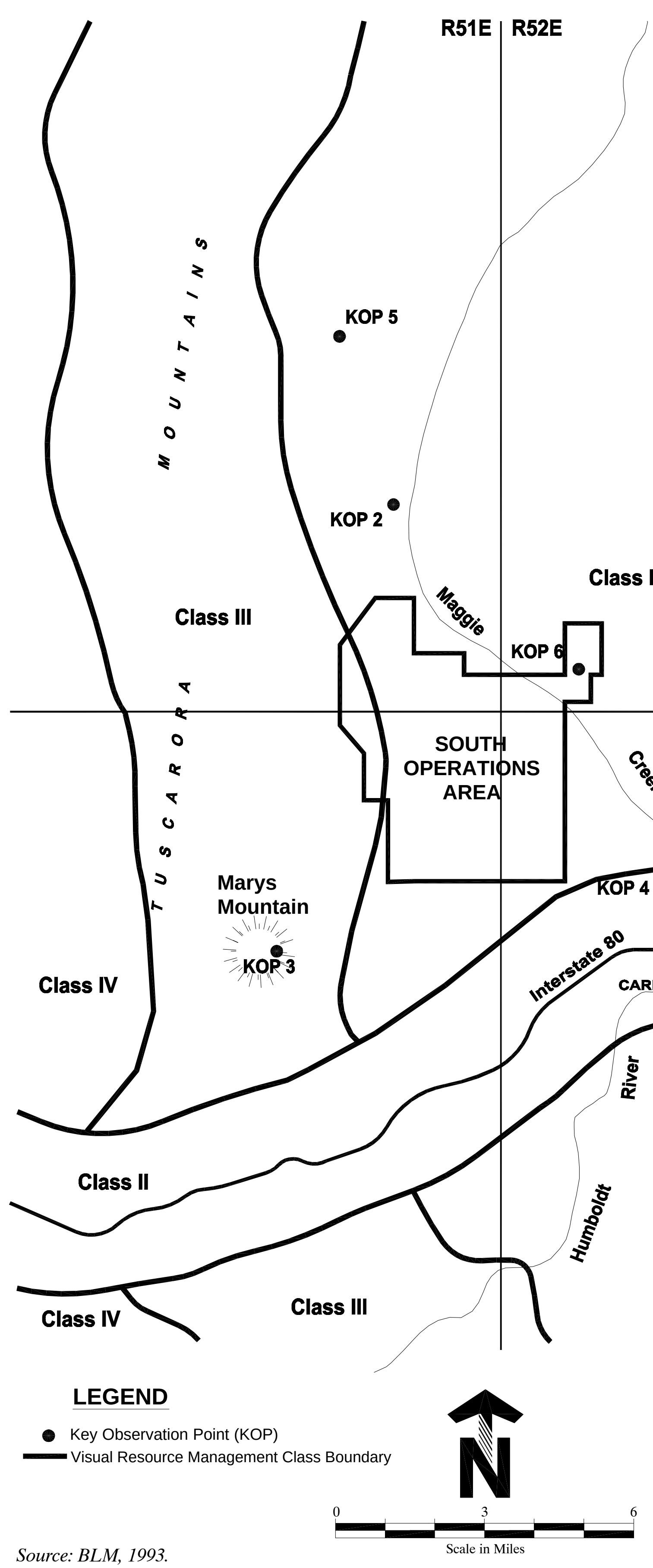
1 0 1 2 3 Kilometers

Transverse Mercator Projection
1927 North American Datum
Zone 11

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-14
PROJECT VIEWSHED

MINE AREA: SOUTH AREA	
DATE: 3/31/99	ARCVIEW FILE:NEWMONT
SCALE: AS NOTED	DRAWN BY: BN



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-15
VRM CLASS BOUNDARIES

MINE AREA: SOUTH AREA	
DATE: 7/6/00	ACAD FILE: Fig3-15.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

Highway 766. This view represents that of commuters and local residents on State Highway 766. KOP 4 affords a horizontal view of the project site, approximately 2½ miles away. While this KOP is located within the Class II highway corridor, it is visually separated from the highway by a low ridge north of Carlin. Views are primarily to the northeast, north, and northwest, with the mine in the middleground to the northwest. The angular, geometric forms and horizontal lines of the existing mine facilities contrast moderately with the flat to rolling forms and horizontal lines of the characteristic landscape. Patchy color patterns, including dark grays and pastel reds, contrast strongly with the chalky buff and gray-green of the characteristic landscape.

KOP 6 is located on private land on the access road from the cooling towers to the Maggie Creek Ranch reservoir. The road also provides access to public lands immediately north of the reservoir. KOP 6 affords a horizontal view of the project site from an elevation approximately 100 feet above the valley floor and approximately two miles east of the project site. KOP 6 represents the view of a back-country or off-road recreationist traveling on BLM roads in the hills between Maggie Creek and Susie Creek after having gained entry from a few limited access points. The view is similar to that of persons traveling on Highway 766, however, its location is farther away and at a higher elevation than Highway 766, thus providing a view with mine facilities in the middleground rather than in the foreground. The angular, geometric forms and horizontal lines of the existing mine facilities contrast strongly with the flat to rolling forms of the characteristic landscape. Patchy color patterns of the mine facilities contrast moderately to strongly with the chalky buff, and orange-tan of the characteristic fall/winter colors. In spring/summer, green vegetative colors can contrast strongly with the tan and brown colors of the mine facilities.

NOISE

The study area for noise concerns is the area inside a line 50 feet outside of the amendment area boundary. Discussions of environmental noise do not focus on pure tones. Commonly heard sounds have complex frequency and pressure characteristics. Accordingly, sound measurement equipment has been designed to account for the sensitivity of human hearing to different frequencies. Correction factors for adjusting actual sound pressure levels to correspond with human hearing have been determined experimentally. For measuring noise in ordinary environments, A-Weighted correction factors are employed. The filter de-emphasizes the very low and very high frequencies of sound in a manner similar to the response of the human ear. Therefore, the A-weighted decibel (dBA) is a good correlation to a human's subjective reaction to noise.

The following discussion sets a basis of familiarity with known and common noise levels. A quiet whisper at five feet is 20 dBA; a residential area at night is 40 dBA; a residential area during the day is 50 dBA; a large and busy department store is 60 dBA; a typical construction site is 80 dBA; a freight train at 50 feet is 90 dBA; and a jet takeoff at 200 feet is 120 dBA.

The Occupational Safety and Health Administration has established 90 dBA as a permissible noise exposure for an eight-hour period (Marsh, 1991). This limit is below the level of 130 dBA recognized as the noise related to the threshold of pain.

The overall noise level at the South Operations Area is a combination of noise produced by many sources to include blasting, bulldozers, dumping and loading ore and waste rock, trucks, crushers and milling operations. Typical noise levels associated with these sources are shown in **Table 3-29**.

Noise generated on the mine site was estimated from 85 to 100 dBA excluding blasting (BLM, 1993). Because the overall noise is the logarithmic summation of all noise sources, the overall noise of the mine site is estimated to be 107 dBA at a distance 50 feet from operating mining equipment. For an area source, the noise at a distance from the area can be estimated (Bell, 1982) by the relationship:

$$L_2 = L_1 - 10 \log (R_2/R_1)$$

where:

L_2 = noise level at the center of the area;
L_1 =noise level measured at a distance;
R_1 = from the center of the area; and
R_2 = distance from the center of the area where noise is estimated.

This relationship holds for a distance of approximately ½ mile from the edge of the area. Beyond 0.5 mile, noise can be calculated by the relationship:

$$L_2 = L_1 - 20 \log (R_2/R_1)$$

Using these noise propagation equations and using the dimensions of the mine to be approximately a 5-mile square, the noise surrounding the study area can be estimated as shown on **Figure 3-16**.

LAND USE AND ACCESS

The study area for the general description of land ownership and land use is Elko County and the northern portions of Eureka and Lander counties. The general region includes the area within approximately 50 miles of the project area. The analysis focuses on the project area, which consists of BLM lands and private lands in Elko and Eureka counties.

Land Ownership

Land ownership within and adjoining the project area consists of a checkerboard pattern of BLM-administered public and private lands. The total project area comprises 11,636 acres, most of which is located in Eureka County. Land ownership in the project area is shown in **Figure 2-1**. The project area includes all or part of Sections 25-28, 33-36, T34N, R51E; Sections 1-4, 10-15, T33N, R51E; Sections 29, 31, 32, T34N, R52E; and Sections 6, 7, and 18, T33N, R52E in Eureka and Elko counties, Nevada.

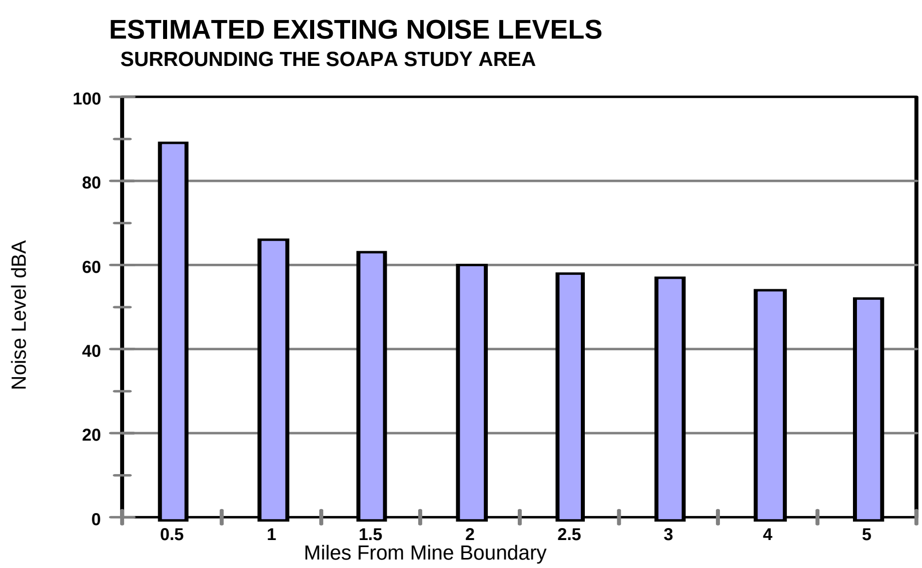
Land Use

The primary land use on public and private lands in the project area consists of the existing Newmont mine operations. There is a total of 7,960 acres of existing and approved disturbance on public and private lands in the South Operations Area. Most of the existing mining facilities and operations are on private land owned by Newmont. There are 5,913 acres of existing and approved surface disturbance on private lands. Approximately 2,047 acres of facilities consisting of waste rock dumps, mining pits, tailing impoundments, heap leach and bioleach

TABLE 3-29 NOISE LEVELS OF MINING EQUIPMENT AND OPERATIONS	
Equipment/Operation	**Noise Level (dBA)**
Blasting	115-125 dBA at 900 feet
Crusher	95 dBA at source
Haul Trucks	90 dBA at 50 feet
Loaders	87 dBA at 50 feet
Blasthole Drilling	86 dBA at 50 feet
Bulldozers	85 dBA at 50 feet

Source: BLM, 1993.

Figure 3-16 Estimated Existing Noise Levels



facilities, and other facilities extend onto public lands. Other land uses adjacent to mine facilities include grazing, recreation, and wildlife habitat.

One federal oil and gas lease exists within the project area (N-53873). Public lands in the project area remain open for mineral entry for oil and gas and other minerals. Four utility and road rights-of-way were identified on public lands in the project area. Elko 1655 is an aerial telephone line granted to Nevada Bell. NEV 067173 is a state highway right-of-way permit granted by the Nevada Department of Transportation for State Highway 766. A powerline and a pipeline in right-of-way N-46404 granted to Newmont provide electricity and water to the South Operations Area. The Sierra Pacific Powerline right-of-way (N-47775) is a 120-kV distribution line that crosses through the northern portion of the project area, and right-of-way (56093) is for another powerline traversing the site. Wells Rural Electric also has a powerline grant on the site.

Access

The project area is approximately six miles north of Carlin on State Highway 766. The highway is parallel to Maggie Creek on private and BLM administered public lands between the project area and its intersection with Interstate 80 on the north side of the town of Carlin. The primary access into the project area is on a private road that connects with State Highway 766 in Section 31, T34N, R52E. The private road is gated and closed to public access.

The Nevada Department of Transportation (1997) has established a counting station on State Highway 766 north of Carlin. The most recent 1996 average daily traffic counts at the station were 1,434 vehicles in the northbound lane and 1,488 vehicles in the southbound lane. Peak periods occurred at 5:00 to 7:00am in the northbound lane and 3:00 to 5:00pm in the southbound lane, reflecting worker commutes between Carlin and the mine. The counts at the station differed between the north bound and southbound lanes because it is probable that the traffic includes people who are not commuting between Carlin and the mine, but who accessed the southbound lane from State Highway 226, or private residences along State Highway 766, and did not make a return trip in the northbound lane.

There are numerous two-track and four-wheel drive BLM roads adjacent to the project area. BLM roads within and connecting to the project area include roads #1238, #1239, #1388, and #1392. Areas to the north of the project area are accessed by BLM roads #1237 and #1391. Roads #1392, #1393 and #1394 access areas to the east of the project area.

BLM Road #1238 formerly crossed through the mine area along James Creek. Public access to road #1238 is now blocked by mine facilities in T33N, R51E. BLM Road #1239 approaches the project area from the southeast, and is now blocked by the mine at Section 7, T33N, R52E. These roads are fenced to prevent access for safety reasons.

Many of the roads on public lands in the project area resulted from historic mineral exploration and mine development, and are currently used for access to grazing allotments, or are utilized by hunters, campers or other recreationists. BLM roads identified on the BLM Transportation Map may not provide legal access even though they provide physical access.

Land Use Planning and Management

BLM Land and Resource Management Plan

The Elko Field Office of the BLM administers the public lands in the project area. General management guidance is to manage public land under the principles of multiple-use and sustained-yield (BLM, 1987). Newmont's Proposed Action is in conformance with the Elko Field Office Resource Management Plan-Minerals Management Prescription.

County Land Use Planning

Land use controls for private lands include county plans and zoning ordinances. In Eureka County, land use is managed through the Eureka County Master Plan and the county zoning ordinance.

Elko County plans to update the current land use plan for the County, which was adopted in 1971. The Elko County Commissioners have adopted an interim land use plan, the Elko County Federal Land Use Plan.

CULTURAL RESOURCES

Cultural resources are known to exist within the South Operations Area (**Figure 3-17**) and were documented by the BLM (1993). The study area for cultural resources is the same as the amendment area.

Several overviews of the regional prehistory have been completed in the past 20 years (BLM, 1993). In many ways, these studies update the earlier overview of prehistory by James (1981). The cultural history of the Great Basin was summarized by the BLM (1993).

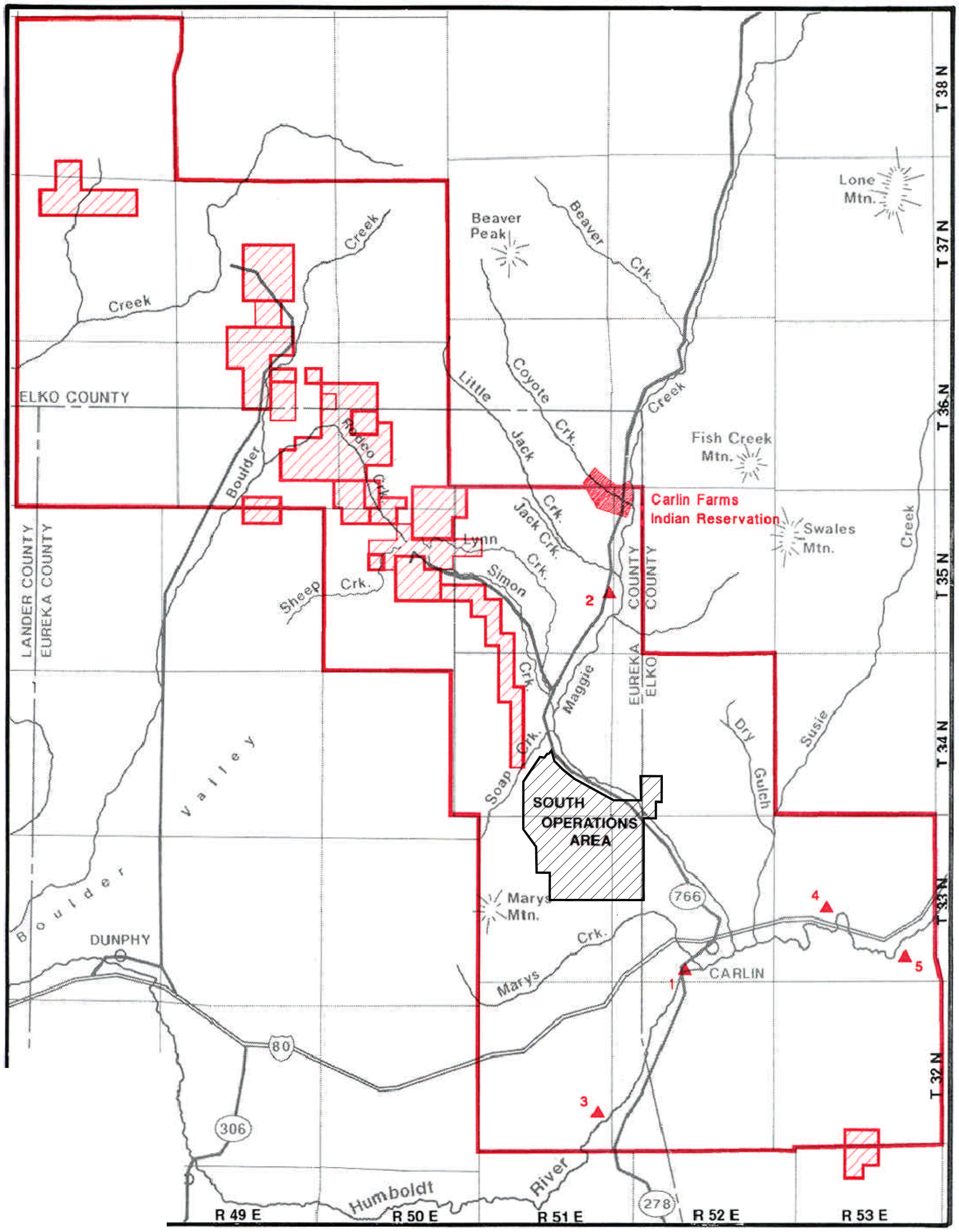
An intensive cultural resource inventory of four parcels was recently conducted to complete the cultural resource inventory of all previously unsurveyed areas in the South Operations Area Project existing facilities and proposed actions (Newsome and Tipps, 1997 - report BLM 1-1651(P)). A literature review and summary of previous investigations are presented in that document and are summarized here. The latter survey covered 3,125 acres in four parcels in the project area. The files search conducted for the project area (Newsome and Tipps, 1997) indicated that 9 previous investigations had included portions of the project area (included in **Table 3-30**).

The earlier investigations documented two prehistoric sites (CRNV-12-3283 and CRNV-12-8325) within the project area. Both of the latter sites were revisited, documentation was updated, and they were re-evaluated for National Register eligibility. The investigation divided previously recorded site CRNV-12-3283 into three discrete sites (CRNV-12-3283, CRNV-11-9298, and CRNV-11-9299), and recorded 12 previously undocumented prehistoric sites, one historic site, and seven isolated finds (Newsome and Tipps, 1997).

One of the previously recorded prehistoric sites (CRNV-12-3283) and three newly documented prehistoric sites (CRNV-11-9292, CRNV-11-9293, and CRNV-11-9294) were determined eligible for the National Register by the BLM, and three sites were unevaluated (CRNV-11-9279, CRNV-11-9290, and CRNV-11-9291). The remaining ten sites and seven isolated finds were determined by the BLM to be non-significant and not eligible for the National Register. The Nevada State Historic Preservation Officer (1997) concurred with these determinations. Avoidance and protection were recommended for the eligible and unevaluated properties. If these properties cannot be avoided, data recovery plans will be prepared in consultation with the BLM and the Nevada State Historic Preservation Office to mitigate the adverse impacts to the information potential of the resources. It is recommended that data recovery plans for the unevaluated sites include an evaluative testing phase to define the nature and extent of significant data classes and, if necessary, refine the data recovery plan.

Table 3-30 presents a summary of all previous cultural resource investigations in the project area. With the completion of the amendment area inventory (Newsome and Tipps, 1997) the entire project area and amendment area, excluding several small areas of extensive mining disturbance predating systematic cultural resource investigations, have been inventoried for cultural resources.

There have been 25 previous cultural resource investigations in the South Operations Area Project, including the recent P-III investigation. These investigations are briefly summarized in Newsome and Tipps, (1997).



▲ Winter Village

1. Badukoi, Carlin District
2. Maggie Creek District
3. Palisades District
4 and 5 Elko District

Mining Disturbance

Study Area Boundary

0 3 6 9 12

Scale in Miles

Source: BLM, 1993.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-17
CULTURAL RESOURCES AND NATIVE AMERICAN RELIGIOUS CONCERNS

MINE AREA: SOUTH AREA	
DATE: 6/6/00	ACAD FILE: Fig3-17.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

TABLE 3-30
CULTURAL RESOURCE INVESTIGATIONS COMPLETED IN THE SOAPA STUDY AREA, PROJECT AREA, AND AMENDMENT AREA

BLM Report #	Author(s) date (block or linear)	Acres (in SOAP)	Sites Found	Sites Revisited	Eligible
1-330(N)	Nelson, 1980 (linear)	0.75	0	0	0
1-642(P)	Gallagher et al., 1982 (linear)	274 (23)	0	0	0
1-682(P)*	Clerico, 1983 (block)	1760	15	0	0
1-727(P)	Clerico et al., 1983 (n/a)	(testing)	0	6	1
1-967(P)	Matranga, 1985 (linear)	330	1	0	0
1-1126(P)*	Johnson, 1987 (linear)	260	0	0	0
1-1324(P)	Popek and Strand, 1990 (block)	640	0	0	0
1-1340(P)	Popek and Schroedl, 1990 (block)	640	3	0	0
1-1341(P)	Tipps et al., 1990 (block)	1276	8	0	0
1-1403(P)	Lennon and Peterson, 1991 (block)	1930	1	0	0
1-1480(P)*	Brewster, 1990 (linear and block)	1	1	0	0
1-1501(P)	Hause, 1991 (linear and block)	60	0	0	0
1-1505(N)*	Popek and Tipps, 1991 (linear)	38	0	0	0
1-1584(P)	Elston and Budy, 1990 (n/a)	(data recovery)	0	1	1
1-1640(P)	Newsome, 1992 (block)	505	2	0	0
1-1722(P)*	Kice, 1993 (linear and block)	756	6	0	1
1-1725(P)	Newsome, 1993 (linear and block)	1051	8	0	3
1-1746(P)*	Tipps and Newsome, 1993 (block)	82	0	0	0
1-1788(P)*	Kautz, 1993 (linear)	860	16	0	0
1-1807(P)	Kenzle, 1993 (linear and block)	300	5	0	0
1-1888(N)*	Kenzle, 1994 (linear)	3	0	0	0
1-1905(P)*	Newsome, 1994a (linear and block)	130	2	0	0
1-1926(N)	Newsome, 1994b (linear and block)	56	0	0	0
(not BLM)	Schroedl, 1994 (block)	?	6	0	0
1-1651(P)	Newsome and Tipps, 1997 (block)	3125	13	4	4

* These previous investigations included portions of the Amendment Area, Report #1-1651(P).

The previous investigations ranged in size from an acre or less for exploratory cores and telephone cables to the recent survey of over 3000 acres, as well as testing and data recovery investigations at James Creek Shelter. The previous investigations included two excavation projects at James Creek Shelter, nine block area inventories, seven linear corridor inventories, and seven combined linear and block inventories (e.g., block area and access corridor). Several of the larger investigations were predominantly outside the South Operations Area Project. Cultural resource inventories have documented 47 cultural resource sites and 34 isolated finds. The sites included 43 prehistoric open lithic scatters, two of which also contained historic materials, one prehistoric sheltered camp (James Creek Shelter), two historic fences or corrals, a mining complex, and a scatter of early mining-related debris (interpreted as a mining camp). The isolated finds included 24 isolated prehistoric artifacts and eleven historic isolated finds. Thirty-three (77 percent) of the prehistoric lithic scatters were small or sparse scatters containing fewer than 100 artifacts, predominantly chipped stone debitage. Diagnostic artifacts were found at 15 of the sites, five of which had more than one component represented. A total of 21 prehistoric components was identified on the basis of diagnostic artifacts. These included one Early Archaic, six South Fork Phase, five James Creek Phase, five Maggie Creek Phase, and four Eagle Rock Phase. Several of these component identifications are only tentative, because the projectile point type is known to be associated with more than one phase. The remaining 28 prehistoric lithic scatters could not be associated with a discrete prehistoric period or cultural group.

Five of the prehistoric sites were evaluated as having significant information potential and were determined eligible for the National Register (**Table 3-31**). Three of the prehistoric sites were evaluated as having the potential to yield important data classes from buried contexts, and were determined as unevaluated for the National Register pending subsurface testing. One of the eligible sites was James Creek Shelter (CRNV-12- 3320/26EU843). Data recovery investigations have already been completed at James Creek Shelter, and the site is within the Gold Quarry pit. Even though the site has been destroyed, it has made lasting contributions to regional chronology and our understanding of the prehistory of north-central Nevada, and remains a National Register site. The remaining seven eligible and unevaluated sites should be treated as significant historic properties. If these sites cannot be avoided by future mining developments, data recovery plans will be prepared in consultation with the BLM and the State Historic Preservation Office.

NATIVE AMERICAN RELIGIOUS CONCERNS

Previous consultation with members of the Newe/Western Shoshone community was documented in BLM (1993) and was also documented in a report entitled *Consultation With The Western Shoshone Regarding the Proposed Expansion of Newmont Gold Quarry Mine, Carlin, Nevada* (Deaver, 1993).

Since general ethnographic inquiry tends to be broad in scope, the BLM (1993) addressed ethnographic issues relevant to both the area of direct effect and the area of cumulative effect. Consequently, neither the area of direct effect nor the area of cumulative effect was discussed individually. Discussion of the Newe/Western Shoshone history and world-view was presented in BLM (1993).

Based on the consultation conducted in 1993, the following statements characterize the general concerns of Newe/Western Shoshone traditionalists as they pertain to mining activities:

1. Ground-disturbing activities associated with mining can disrupt the flow of spiritual power (Puha) as well as the distribution or disposition of spirits (e.g., Little Men and Water Babies). Maintaining access to undisturbed

TABLE 3-31
ELIGIBLE AND UNEVALUATED CULTURAL RESOURCE SITES IN THE SOAPA AREA, PROJECT AREA, AND AMENDMENT AREA

BLM Site #	SITE #	Site Type	Report #	Action	Evaluation
CRNV-12-3320	26EU843	sheltered camp (James Creek shelter)	1-682(P)	mitigated	eligible
CRNV-12-3283		lithic scatter	1-682(P) and 1-1651(P)	avoid/mitigate	eligible
CRNV-11-9292		lithic scatter with groundstone	1-1651(P)	avoid/mitigate	eligible
CRNV-11-9293		lithic scatter with groundstone	1-1651(P)	avoid/mitigate	eligible
CRNV-11-9294		lithic scatter	1-1651(P)	avoid/mitigate	eligible
CRNV-11-9279		lithic scatter with groundstone	1-1651(P)	avoid/test	unevaluated
CRNV-11-9290		lithic scatter	1-1651(P)	avoid/test	unevaluated
CRNV-11-9291		lithic scatter	1-1651(P)	avoid/test	unevaluated

concentrations of Puha (power spots) and continuing relationships with the spirits is integral to spiritual life.

2. Dewatering efforts, with the resultant reduction or loss of flow to springs, could alter the distribution or disposition of spirits associated with water. Maintaining a relationship with these spirits is integral to spiritual life. Spring water is also used as a sacrament, medicinally, for drinking, in prayer, etc. In addition, some springs are a source of sacred white clay, and burials often take place near these springs.

3. Ground disturbance results in the loss of plants and minerals and used by Western Shoshone traditionalists.

4. Cultural resource inventories conducted by archaeologists prior to mining activities often result in collection of artifacts that Western Shoshone traditionalists consider to be powerful and sacred objects (e.g., complete projectile points and items of Tosawihi chert). Current curation practices can prevent traditionalists from securing these items for use in healing practices, etc.

Additional consultation for the proposed South Operations Area Project Amendment has occurred in two phases **(see Table 3-31a for a summary of BLM's consultation efforts and information exchange related to SOAPA).** Phase I was initiated via certified letter May 22, 1997. The Te-Moak Tribe, Elko Band Council, Battle Mountain Band Council, Wells Band Council, Southfork Band Council, and the Western Shoshone Historic Preservation Society were invited to discuss the potential effects of ground-disturbing activities associated with the SOAPA on areas of cultural or religious importance to the Shoshone people. The South Fork Band Council sent a response to the BLM indicating that they had no concerns or comments about the proposed project. The BLM did not receive a response from the other tribal and band entities, nor from the Western Shoshone Historic Preservation Society. Thus, on June 16, 1997, the BLM called those which did not respond to the initial consultation letter and again invited comments on the project. As a result of these calls, the BLM received a

TABLE 3-31a (continued)
SUMMARY OF BLM'S CONSULTATION EFFORTS AND INFORMATION EXCHANGE RELATED TO SOAPA

Contact Date	Contacted	Via	Response
5/22/97	Te-Moak Tribal Chair Elko Band Chair Battle Mountain Band Chair Wells Band Chair South Fork Band Chair WSHPS[1]	Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter	No response No response No response No response No response No response
6/19/97	Te-Moak Tribal Chair Elko Band Chair Battle Mountain Band Chair Wells Band Chair WSHPS	Phone Call Phone Call Phone Call Phone Call Phone Call	No response No response No response No response Response 6/27/97
8/25/97	Te-Moak Tribal Chair Elko Band Chair Battle Mountain Band Chair Wells Band Chair	Certified Letter Certified Letter Certified Letter Certified Letter	No response No response No response No response
9/28/98	Te-Moak ED[2] Duck Valley ED Elko Band ED Battle Mountain Band ED Wells Band ED South Fork Band ED WSHPS WSDP[5]	Monthly Meetings[3] Monthly Meetings Monthly Meetings Monthly Meetings Monthly Meetings Monthly Meetings Monthly Meetings Monthly Meetings	0 Rep.[4] Present 2 Rep. Present 0 Rep. Present 1 Rep. Present 1 Rep. Present 0 Rep. Present 1 Rep. Present 3 Rep. Present
10/1/98	Te-Moak Tribal Chair Duck Valley Tribal Chair Shoshone-Bannock ED Elko Band Chair Battle Mountain Band Chair Wells Band Chair South Fork Band Chair WSHPS WSDP	Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter	No response No response No response Response 10/16/98 No response No response No response Response 10/16/98 No response
10/26/98	Te-Moak Tribal Chair Duck Valley ED Shoshone-Bannock Chair Yomba Tribal Chair Elko Band Chair Battle Mountain Band Chair Wells Band Chair South Fork Band Chair WSHPS WSDP	Monthly Meetings Monthly Meetings Monthly Meetings Monthly Meetings Monthly Meetings Monthly Meetings Monthly Meetings Monthly Meetings Monthly Meetings Monthly Meetings	0 Rep. Present 1 Rep. Present 0 Rep. Present 0 Rep. Present 0 Rep. Present 1 Rep. Present 0 Rep. Present 0 Rep. Present 1 Rep. Present 2 Rep. Present

TABLE 3-31a (continued)
SUMMARY OF BLM'S CONSULTATION EFFORTS AND INFORMATION EXCHANGE RELATED TO SOAPA

Contact Date	Contacted	Via	Response
12/16/98	Te-Moak Tribal Chair Duck Valley Tribal Chair Shoshone-Bannock ED Elko Band Chair Battle Mountain Band Chair Wells Band Chair South Fork Band Chair WSDP	Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter	No response No response No response No response No response No response No response Response 12/18/98
1/5/99	Te-Moak Tribal Chair Duck Valley Tribal Chair Shoshone-Bannock ED Elko Band Chair Battle Mountain Band Chair Wells Band Chair South Fork Band Chair WSHPS WSDP	Meeting at BLM Meeting at BLM Meeting at BLM Meeting at BLM Meeting at BLM Meeting at BLM Meeting at BLM Meeting at BLM Meeting at BLM	0 Rep. Present 1 Rep. Present 0 Rep. Present 0 Rep. Present 1 Rep. Present 2 Rep. Present 2 Rep. Present 1 Rep. Present 4 Rep. Present
2/2/99	Te-Moak Tribal Chair Duck Valley ED Shoshone-Bannock ED Elko Band Chair Battle Mountain Band ED Wells Band Chair South Fork Band Chair WSHPS WSDP	Meeting at GBC[6] Meeting at GBC Meeting at GBC Meeting at GBC Meeting at GBC Meeting at GBC Meeting at GBC Meeting at GBC Meeting at GBC	0 Rep. Present 2 Rep. Present 0 Rep. Present 1 Rep. Present 1 Rep. Present 0 Rep. Present 0 Rep. Present 1 Rep. Present 3 Rep. Present
2/9/99	Te-Moak Tribal Chair Duck Valley Tribal Chair Shoshone-Bannock ED Elko Band Chair Battle Mountain Band Chair Wells Band Chair South Fork Band Chair WSHPS WSDP	Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter Certified Letter	No response No response No response No response No response No response No response No response No response

TABLE 3-31a (continued)
SUMMARY OF BLM'S CONSULTATION EFFORTS AND INFORMATION EXCHANGE RELATED TO SOAPA

Contact Date	Contacted	Via	Response
3/15/99	Te-Moak Tribal Chair	Meeting at BLM	Response 3/15/99
	Duck Valley Tribal Chair	Meeting at BLM	1 Rep. Present
	Shoshone-Bannock ED	Meeting at BLM	0 Rep. Present
	Elko Band Chair	Meeting at BLM	2 Rep. Present
			Response 3/23/99
	Battle Mountain Band Chair	Meeting at BLM	0 Rep. Present
	Wells Band Chair	Meeting at BLM	0 Rep. Present
	South Fork Band Chair	Meeting at BLM	2 Rep. Present
	WSHPS	Meeting at BLM	0 Rep. Present
	WSDP	Meeting at BLM	3 Rep. Present
			Response 5/21/99
	Yomba Tribe	Meeting at BLM	1 Rep. Present
7/22/99	South Fork Band ED	In the Field	2 Rep. Present
	Wells Band ED	In the Field	1 Rep. Present
	Elko Band ED	In the Field	1 Rep. Present
	Battle Mountain Band ED	In the Field	4 Rep. Present
9/2/99	Te-Moak Tribal Chair	Fax	No response
	Duck Valley Tribal Chair	Fax	No response
	Elko Band ED	Fax	No response
	Battle Mountain Band ED	Fax	No response
	Wells Band Chair	Fax	No response
	South Fork Band Chair & ED	Fax	No response
	WSHPS	Fax	No response
	WSDP	Fax	No response
3/15/00	Te-Moak Tribal Chair	Monthly Meetings	1 Rep. Present
	Duck Valley ED	Monthly Meetings	0 Rep. Present
	Shoshone-Bannock Chair	Monthly Meetings	0 Rep. Present
	Elko Band Chair	Monthly Meetings	0 Rep. Present
	Battle Mountain Band Chair	Monthly Meetings	2 Rep. Present
	Wells Band Chair	Monthly Meetings	1 Rep. Present
	South Fork Band Chair	Monthly Meetings	2 Rep. Present
	Ely Shoshone Tribe	Monthly Meetings	2 Rep. Present
	WSDP	Monthly Meetings	2 Rep. Present
9/26/00	Te-Moak Tribal Chair	Certified Letter	Response 10/30/00
	Duck Valley Tribal Chair	Certified Letter	No response
	Elko Band Chair	Certified Letter	No response
	Battle Mountain Band Chair	Certified Letter	Response 11/14/00
	Wells Band Chair	Certified Letter	Response 10/19/00
	South Fork Band Chair	Certified Letter	No response
	WSDP	Certified Letter	Response 10/31/00
	Ely Shoshone Tribe	Letter	Response 10/31/00
	Lois Whitney, WSA[7]	Letter	Response 10/31/00

TABLE 3-31a (continued)
SUMMARY OF BLM'S CONSULTATION EFFORTS AND INFORMATION EXCHANGE RELATED TO SOAPA

Contact Date	Contacted	Via	Response
9/27/00	Te-Moak Tribal Chair Elko Band Chair Battle Mountain Band Chair Wells Band Chair South Fork Band Chair WSDP Duckwater Tribe	Monthly Meetings Monthly Meetings Monthly Meetings Monthly Meetings Monthly Meetings Monthly Meetings Monthly Meetings	1 Rep. Present 1 Rep. Present 1 Rep. Present 1 Rep. Present 2 Rep. Present 1 Rep. Present 2 Rep. Present
11/28/00-12/7/00	Te-Moak Tribal Chair & ED Duck Valley Tribal Chair Elko Band Chair Battle Mountain Chair & ED Wells Band Chair & ED South Fork Band Chair WSDP Ely Shoshone Chair & ED Lois Whitney, WSA	CL[8]/Meeting at BLM CL/Meeting at BLM CL/Meeting at BLM CL/Meeting at BLM CL/Meeting at BLM CL/Meeting at BLM Letter/Meeting at BLM CL/Meeting at BLM Letter/Meeting at BLM	0 Rep. Present 0 Rep. Present 0 Rep. Present 1 Rep. Present 2 Rep. Present 1 Rep. Present 2 Rep. Present 0 Rep. Present Present

[1] Western Shoshone Historic Preservation Society
[2] Environmental Division
[3] Information exchange meetings held on a regular basis between the BLM and the Western Shoshone
[4] Denotes number of representatives present at the meeting
[5] Western Shoshone Defense Project
[6] Great Basin College
[7] Western Shoshone Advocate
[8] Certified Letter

response from the Western Shoshone Historic Preservation Society. The Western Shoshone Historic Preservation Society indicated that the lands which encompass the mine were owned not by the federal government but by the Western Shoshone people, and that the Western Shoshone Historic Preservation Society did not approve of the project. No specific comments were offered, and no specific areas of cultural or religious significance to the Western Shoshone people were revealed. On August 25, 1997, the BLM sent certified letters to the Te-Moak Tribe, Wells Band, Battle Mountain Band, and Elko Band stating that the BLM had not received a response from them for the past 90 days. The letter stated that, as a result of not receiving a response, the BLM intended to consider consultation complete for the proposed project, and that the tribe and bands had no comment. The BLM received no comments as a result of the letter.

Phase II of the current consultation effort involved the cumulative environmental impacts of mine dewatering at Newmont's Gold Quarry and proposed Leeville operations, together with Barrick's Betze operation. Consultation on the cumulative effects of mine dewatering on Western Shoshone culture and religion was initiated on October 1, 1998, and is currently ongoing. Please see the "Native American Religious Concerns" section of the technical document entitled "Cumulative Impact Analysis of Dewatering Operations for Betze Project, South Operations Area Project Amendment and Leeville Project" for details of this consultation effort. However, the main findings of this consultation effort to date are briefly described below.

The consultation for mine dewatering resulted in the identification of two Traditional Cultural Properties (TCPs), one along Rock Creek and one at the Tosawihi Quarries. The BLM determined that the Rock Creek area was eligible for the National Register as a TCP under criteria a, c, and d, and the Tosawihi Quarries area was eligible for the National Register as a TCP under criteria a and d. In a letter dated May 19, 1999, the Nevada State Historic Preservation Office concurred with the BLM's determinations. In addition to the TCPs, the Western Shoshone expressed concern about the declining numbers of sage grouse, and the overall impact of the loss of native plants and animals, as well as water resources, on their traditional cultural practices.

SOCIAL AND ECONOMIC RESOURCES

The socioeconomic study area for this project encompasses Elko and Eureka counties and the communities of Elko, Carlin, and Spring Creek, and the Elko Band Colony. The geographic scope of this coverage is defined primarily by the economic reach of existing mining operations. These communities have been selected because they represent the primary areas of residence of existing Newmont employees. Because the South Operations Area Project is located in Eureka County which will continue to receive tax revenues with continued mining operations, it has also been included in the study area.

Most of the workers employed by Newmont and their families do not reside in Eureka County due to long commuting distances between the mine and Eureka County communities. Information related to public finance in Eureka County is presented in this analysis, however, social and public utility and service information is not included because of the negligible impact anticipated in these areas as a result of this project.

The EIS prepared in 1993 (BLM, 1993) described the social history and attitudes toward social well-being in Elko County. The following paragraphs present baseline information related to population, labor and employment, housing, public utilities and services, public finance, energy, and environmental justice. The discussion attempts to focus on elements that have changed over the past five years.

Population

Nevada's population grew from 800,508 in 1980 to 1,688,600 in 1996, an increase of 888,092 individuals, an approximate 111 percent increase. The majority of this increase can be attributed to in-migration associated with jobs generated by the gambling-related service sector, mining industry, and construction sector.

Elko County has experienced a tremendous growth in population over the last 10-15 years. Much of the population growth in Elko County has been concentrated in Carlin and Elko and is primarily attributable to exploration and mining activity in the area. According to Nevada Department of Taxation, the population of Elko County increased from 33,770 in 1990 to 43,630 in 1996, an increase of 30 percent. The City of Elko had a population of 14,950 in July 1990 and 18,570 in July 1996, a 24 percent increase over the 6-year period.

The communities of Carlin and Spring Creek have also experienced substantial growth. Between 1990 and 1996, the population of the City of Carlin experienced 12 percent growth from 2,410 in 1990 to 2,710 in 1996. Spring Creek grew from a population of 5,866 in 1990 to 10,820 in 1995, an absolute increase of 84 percent. Demographic characteristics of Carlin differ slightly from Elko County, Elko, and Spring Creek. Carlin has a higher percentage of males, more residents in the 18- to 44-year-old age category, fewer residents 25 years old and older with more than a high school education, and fewer family households. These differences could be due to a larger population of miners in Carlin than in the other communities.

Table 3-32 provides population data for Nevada, Elko County, City of Elko, City of Carlin, community of Spring Creek, Elko Band Colony, and Eureka County. **Figure 3-18** displays the population growth trend for Eureka County, Elko County, and the cities of Elko and Carlin.

Nevada's population is projected to continue its upward growth trend, increasing by as much as 42 percent between 1995 and 2015, leading to a statewide population of 2,179,000. Similarly, Elko County is projected to grow in population, reaching 64,467 people in 2016, a 41 percent increase over the 1996 population.

Labor and Employment

Civilian Labor Force

In 1997, employment in the State of Nevada was dominated by service industries, accounting for approximately 42 percent of the state's jobs. Retail and wholesale trade, the next largest employment sector, provided about 19 percent of jobs statewide. Approximately 1.5 percent of jobs statewide were in the mining industry.

In 1997, the largest employment in Elko County was in the service industry sector, employing approximately 40 percent of the county's workers. The trade sector accounted for 19 percent of employment, while government jobs comprised 15.5 percent of the total. Employment data for March 1998 indicates that the mining industry employed 1,220 workers, a decrease of 90 workers (nearly 7 percent) from the 1997 mining employment of 1,310 workers.

The total labor force in Eureka County is 810 workers, which contrasts with the total number of available jobs of 4,850 in the county. This discrepancy occurs because many workers employed in Eureka County, mainly by the Carlin Trend mines, reside in Elko County.

The largest industry sector in Eureka County is mining at 82 percent, with the balance shared between construction, government and trade jobs. **Table 3-33** provides the 2000 employment distribution by industry data for Nevada and Elko and Eureka counties. The labor force distribution data provided in **Table 3-33** is presented graphically in **Figure 3-19**.

Agriculture plays an important role in the economies of Eureka and Elko Counties, and has provided a stable employment and income base in both counties. Agriculture employs a small number of workers relative to other industry sectors, as shown in **Table 3-33,** primarily because of increases in productivity through the use of pivot irrigation systems, which require less labor while achieving

TABLE 3-32
POPULATION CENSUS DATA AND POPULATION ESTIMATES

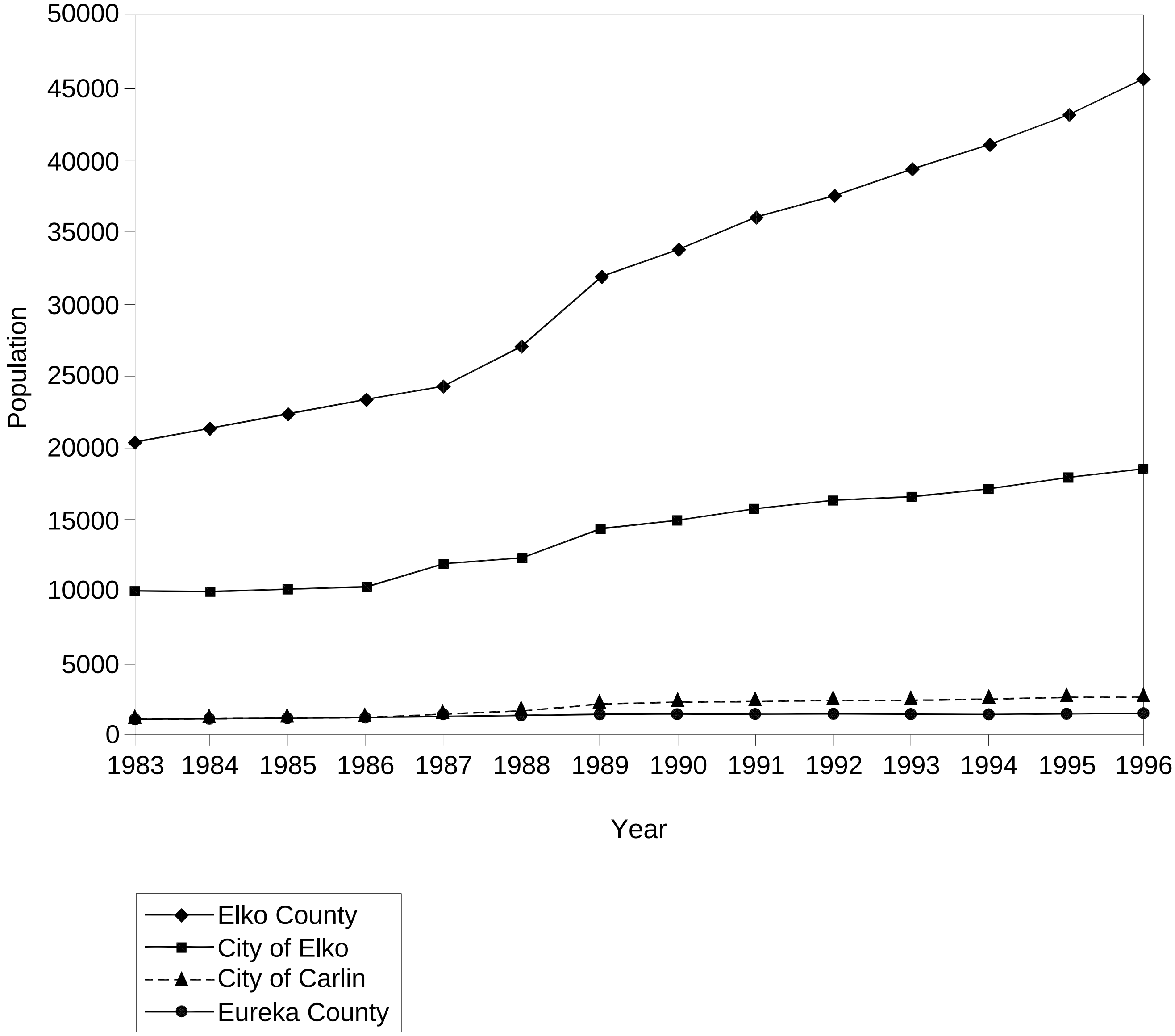
	1980[1]	1986	1990	1992	1994	1995	1996
Nevada	800,508	993,220	1,236,130	1,343,940	1,494,230	1,582,390	1,688,600
Elko County	17,269	23,320	33,770	37,420	41,050	43,050	45,630
City of Elko	8,771	10,320	14,950	16,270	17,110	18,000	18,570
City of Carlin	1,233	1,350	2,410	2,240	2,470	2,690	2,710
Spring Creek	2,002	na	5,866	na	na	10,820[2]	na
Elko Band Colony	na	519[3]	1,158[3]	na	na	1,326[4]	na
Eureka County	1,198	1,330	1,550	1,580	1,550	1,580	1,650

Source: Nevada Department of Taxation and Nevada State Demographer, annual data recorded July 1, 1997a.
1 provided by U.S. Bureau of the Census, 1991.
2 provided by Elko County Chamber of Commerce, July 2, 1995.
3 provided by Bureau of the Census, 1991.
4 provided by BIA, 1995.
na = not available.

TABLE 3-33
LABOR FORCE DISTRIBUTION BY INDUSTRY, 1997 ANNUAL AVERAGE NEVADA, ELKO COUNTY AND EUREKA COUNTY

	Nevada		Elko County		Eureka County	
	Number of Jobs	Percent of Total	Number of Jobs	Percent of Total	Number of Jobs	Percent of Total
Farm Employment	4,732	0.43%	814	3.25%	123	2.37%
Non-Farming Employment						
Agri. Serv., Forestry, Fisheries & Other	11,728	1.08%	(D)	0.00%	42	0.81%
Mining	16,051	1.47%	1,485	5.92%	4,276	82.42%
Construction	97,204	8.92%	1,674	6.67%	151	2.91%
Manufacturing	44,166	4.05%	331	1.32%	(L)	0.00%
Transportation & Public Utilities	51,118	4.69%	1,040	4.15%	(L)	0.00%
Wholesale Trade	37,744	3.46%	876	3.49%	(D)	0.00%
Retail Trade	173,938	15.96%	3,879	15.47%	128	2.47%
Finance, Insurance & Real Estate	76,353	7.01%	(D)	0.00%	(D)	0.00%
Services	459,928	42.21%	9,976	39.77%	148	2.85%
Government	116,560	10.70%	3,899	15.55%	275	5.30%
Total Employment	1,089,522	100.00%	25,082	100.00%	5,188	100.00%

Source: Regional Economic Information System, 2000.
(D) Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.
(L) Less than 10 jobs, but the estimates for this item are included in the totals.



Source: Nevada Department of Taxation, 1997a.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-18
POPULATION TREND

MINE AREA: SOUTH AREA	
DATE: 6/6/00	ACAD FILE: Fig3-18.DWG
SCALE: NTS	DRAWN BY: EC, MODIFIED BY DS

greater productivity. In 1997, cash receipts from the sale of agricultural products totaled more than $13 million in Eureka County and more than $49 million in Elko County. These revenues were generated mostly by the sale of livestock and livestock products. Crops produced in the counties include forage, grains, and alfalfa.

Unemployment

Recent (April through June 1997) employment and unemployment data for Nevada, Elko County, and Eureka County is presented in **Table 3-34**.

Nevada's current unemployment rate is 4.4 percent. At 4.7 percent, Elko County's unemployment rate is slightly higher than the State's. Of the 810 workers residing in Eureka County, 7.8 percent are unemployed.

The Elko Band Council, the Te-Moak Tribe, the Te-Moak Housing Authority, the Bureau of Indian Affairs, and the U.S. Indian Health Service are the basic employers of the Elko Band Colony (BLM, 1993). Bureau of Indian Affairs data from 1995, estimates the labor force of Colony at 728 workers, of these 20 are unemployed, representing an unemployment rate of 3 percent (BIA, 1995).

Newmont Employment

Currently, Newmont employs approximately 2,950 people in Nevada, and approximately 1,000 people in the South Operations Area Project (Newmont, 1999a personal communication).

Housing

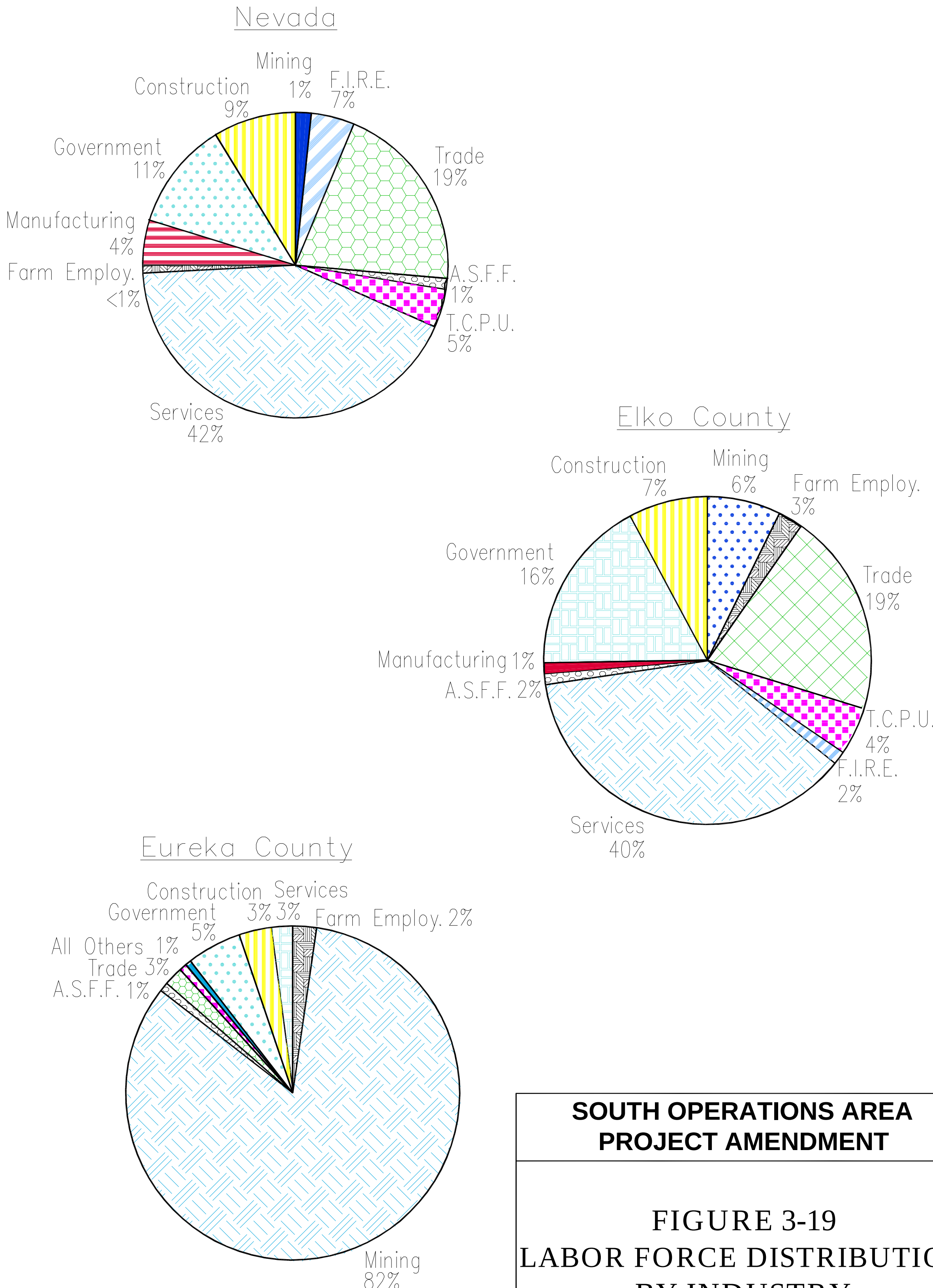
In the mid-1980s, the availability of housing stock in the Elko County area was extremely limited, and the housing market was considered very tight. This condition was due to a significant increase in mining in the Carlin Trend and subsequent influx of people into the area. The availability of housing was so limited that in some cases people were forced to live in overcrowded conditions, in parked cars on private property, on federal land, in parking lots, and in motels and tents. This situation has subsequently been alleviated and to satisfy the demand for housing, developers responded with increased construction of houses and apartment complexes.

In 1997, there were 15,117 housing units in Elko County, of which about 90 percent were occupied (Elko County Assessor, 1997). In the unincorporated community of Spring Creek,

TABLE 3-34
EMPLOYMENT AND UNEMPLOYMENT INFORMATION, 1997

	Total Labor Force	Employment	Unemployed	Unemployment Rate
Nevada	912,600	869,200	43,400	4.4
Elko County	22,050	21,010	1,040	4.7
Eureka County	810	750	60	7.8

Source: Nevada Department of Employment, Training, and Rehabilitation, 1997b.



A.S.F.F. - Agricultural Service, Forestry, Fisheries
T.C.P.U.- Transportation, Communication, Public Utilities
F.I.R.E.- Finance, Insurance, Real Estate

Source: Nevada Department of Employment, Training, and Rehabilitation, 1997b.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-19
LABOR FORCE DISTRIBUTION BY INDUSTRY

DATE: 6/6/00	ACAD FILE: Fig3-19.DWG
SCALE: NTS	DRAWN BY: EC, MODIFIED BY DS

the vacancy rate was 5.6 percent, as there were approximately 2,500 housing units in 1999, with approximately 2,350 occupied units (Ross Realty, 2000). Forty percent of the housing units in the county were one-unit structures, 2 percent were two- to four-unit structures, and 58 percent were "other," including mobile homes. In 1997, there were 900 housing units in Carlin with over 90 percent occupancy (Elko County Assessor, 1997). Carlin had slightly more two-to-four unit structures than Elko, but the one-unit structures and "other" class structures were similar.

Table 3-35 provides current (July 1997) housing statistics by type for Elko County and the Cities of Elko, Carlin, and Spring Creek. Of the total 15,117 housing units in Elko County, 46 percent are single family homes, 40 percent are mobile homes, 12 percent are multifamily units, and 2 percent are agricultural residences. There are currently (1999) 3,261 lots available for all types of housing units in Spring Creek (Elko County Assessor, 1999). Some lots are not developed with a housing unit.

The 1980 census data indicates that the average single-family home for the City of Elko and Elko County was $54,900 and $49,900, respectively. By 1990, home prices increased to $90,000 for the City of Elko, $60,000 for Elko County. Recent 1996 Northeast Nevada Development Authority statistics show the City of Elko average home price as $127,667, and $115,000 for Elko County.

Housing at the Elko Band Colony is fairly limited. There are 221 single-family housing units and a senior/ citizens/handicapped apartment complex with 10 apartments. Construction of additional housing at the Colony is not anticipated in the near future (BLM, 1993).

Public Utilities and Services

Schools

Elko County School District provides educational facilities throughout the County. Current enrollment statistics for the major schools within the district are identified in **Table 3-36.**

TABLE 3-35
ELKO COUNTY, TOTAL HOUSING UNITS, JULY 1, 1997

	Property Type						
	Single Family Detached	**Single Family Attached**	**Mobile Homes (Secured and Unsecured)**	**Multifamily (Total # of Individual Units)**	**Agricultural Residential**	**Total**	**Vacancy Rate**
Elko County	6556	400	6001	1803	357	15,117	
City of Elko	3315	308	1524	1187	0	6334	10%
City of Carlin	362	24	476	36	2	900	10%
Spring Creek	N/A	N/A	N/A	N/A	0	1914	5.4%

Source: Elko County Assessor, 1997.

TABLE 3-36
ELKO COUNTY SCHOOL DISTRICT ENROLLMENT STATISTICS

School	Grades	Number of Students Spring 1997	Current Capacity
Elko Grammar No. 2[1]	K-6	562	590
Southside Elementary[1]	K-6	687	820
Northside Elementary[2]	K-6	653	730
Mountain View Elementary[1]	K-6	839	870
Spring Creek Elementary[3]	K-6	808	915
Spring Creek Middle School	6-8	651	750
Spring Creek High	9-12	728	850
Sage Elementary[4]	K-5	563	650
Elko Junior High[5]	7,8	715	750
Elko Senior High	9-12	1252	1,300
Carlin Combined	K-12	552	800
Owyhee Combined	K-12	322	500
Wells Elementary Jr./Sr. High	K-12	463	525
Jackpot	K-12	306	400
West Wendover	K-6	555	500
West Wendover Jr./Sr. High	7-12	316	600

Source: Harris, 1997.
1 Includes 2 modular units with a capacity of 60 students each.
2 Includes 3 modular units with a capacity of 60 students each.
3 Includes 4 modular units with a capacity of 60 students each.
4 All modular units.
5 Includes 8 modular units.

The District indicates that its future development plans include the installation of a new modular school site in Elko, Nevada providing additional capacity for about 600 students. All new school construction in Nevada takes place on a pay-as-you-go financing plan, with the necessary funds collected from ad valorem taxes prior to construction. Additional financing for capital facilities is provided through a percentage of the mining net proceeds tax (described later) and additional donations from mining companies.

Great Basin College located in Elko is a two-year institution offering Associates' degrees over a wide curriculum of arts, sciences, and applied sciences, and beginning to offer baccalaureate degrees. The initial four-year program is in Elementary Education, and the next requests that will go to the Board of Regents of the University of Nevada System will be for Applied Sciences, Professional Studies, and Nursing. The College is growing rapidly with a current fill-time-equivalent student population of 1,252. The student population has grown at an annualized rate of 123.6 percent between 1988 and 1998, and the campus has expanded from three to 11 buildings (Mahlberg, 2000).

Education for children in the Elko Band Colony is provided through the Elko County School District. A Headstart Program is housed and operated at the Colony for children between the ages of 3 and 5 and a 5-week summer school for school-aged Indian children operates at the Colony through the Elko County School District. The Elko Band Council, under contract with the Bureau of Indian Affairs, provides higher education and an adult vocational program at the Colony (South Operations Area Project Report).

Law Enforcement

Law enforcement along the state highway system is provided by Nevada Highway Patrol. Law enforcement within the unincorporated portions of Elko County is provided by Elko County Sheriff's Department. The City of Elko Police Department provides law enforcement within the City limits.

The City of Carlin Police Department is accountable for law enforcement within the Carlin city limits, and the Te-Moak Tribe of Western Shoshone Indians are responsible for law enforcement within the Elko Band Colony.

As of 1997, Elko County Sheriff's staffing consisted of 45 sworn sheriff's deputies, (3 of whom are criminal investigators), 17 jail staff, and nine administrative support staff. The department maintains 28 marked patrol vehicles. Jail facilities are provided at the Elko County Jail and provide capacity for 115 inmates. Frequently, the jail is over capacity. The average inmate count on most nights is 110, with 130-140 inmates on busy weekend nights (Stewart, 1997).

The Elko City Police Department consists of 35 sworn officers, 6 civilians and 10 communications personnel. Staffing levels in 1992 provided for a sworn officer/resident ratio of 1:600 (U.S. Department of Agriculture, 1996). Carlin City Police Department staff consists of 5 officers.

Fire Protection

Fire protection services are provided in the unincorporated areas of Elko and Eureka Counties by the Northeastern Nevada Fire Protection Department. The Department consists of seven paid staff and 27 volunteers. Assistance is also provided by the Nevada Division of Forestry, Bureau of Land Management, and Bureau of Indian Affairs, through mutual aid agreements. In general, the agreements specify that firefighters will assist outside of their respective jurisdictions, but recognize that their own jurisdiction has first priority.

Carlin Fire Department serves the area within the Carlin City limits. The Department maintains 30 volunteers.

Fire protection and emergency medical services within the Elko City limits are provided by the Elko Fire Department. The Department has 15 paid firefighters, 21 volunteers, support staff, and seven pumper vehicles. The department maintains an Insurance Service Organization rating of five. This designation is applied to fire protection service areas for insurance purposes and is based on response times, access, available equipment, and other factors. The rating scale ranges from one to nine, with level one being the best protection and level nine generally applied to the most rural areas with only minimal fire protection services available.

Ambulance

Elko county ambulance operates out of Elko General Hospital. The ambulance is staffed by 32 volunteers (all trained emergency medical technicians). Overall, the area is adequately covered by the existing number of volunteers; however, during special events (e.g., country fair, Basque Days), more volunteers are needed. The ambulance is operated and financed through the County funding and fees for services. The two county ambulances are in good condition. Although there is usually adequate number of ambulances to serve the Elko area, one additional vehicle is required when there are special events (BLM, 1993).

Carlin Ambulance is a city run operation, financed by the city and payment of fees for services. It is staffed by 15 to 20 volunteer emergency medical technicians some with emergency training for mine rescue. Two ambulances are maintained. Due to its proximity to SOAPA, Carlin Ambulance would be the first to respond to emergency requests at the mine. Newmont staffs emergency medical technicians on all shifts at the mine to stabilize patients until the Carlin Ambulance arrives (BLM, 1993).

Health Care

Elko general Hospital provides medical facilities for Elko County. This full-service medical facility consists of 50 beds and a 24 hour emergency room as well as a full range of hospital services. The hospital is currently constructing a new facility and is expanding to 75 beds. It provides obstetrical, surgical, and general medical services and maintains a medical staff of 36 practicing physicians, in a range of specialities, including a registered dietician, respiratory therapist, radiology, lab, ultra sound, nuclear medicine, EEG, ICU and CAT-scan (Elko General Hospital, 2000).

Elko clinic is a fifty-bed acute care hospital with a physical therapy department. The staff consists of 12 practicing physicians, 15 contracted physicians, 1 physician assistant, and 11 registered nurses (Desantner, 2000) the Clinic maintains a full service laboratory and X-ray facility (Desantner, 2000).

The Spring Creek Clinic is a satellite office of Elko clinic. The clinic is currently shut down, and there is no staff. However, in August 2000, a family practice doctor will resume operations at the clinic (Link, 2000).

Indian Health Services/Health Center provides comprehensive medical care at Elko Band Colony. It has a pharmacy, a two-chair dental office with a laboratory, and other support services such as community health nurse, alcohol/drug prevention, and after-care programs (BLM, 1993).

Social Services

Social services are provided by Elko County Human Services and Nevada Welfare Department. Elko County Human Services' General Assistance Program assists with rent, food vouchers, utilities, medical services, and food commodities. Nevada Welfare Department program offers food stamps, Medicaid, Aid to Families with Dependent Children, low-income medical assistance, child protective services, and food supplements to pregnant women and women with infants (BLM, 1993).

The Elko Band Council Program (under contract with the BIA) provides Indian general welfare assistance, adult institutional care, Indian child welfare (including foster care and institutional placements). Indigent burial assistance, counseling services, and assistance with social security benefits, disability benefits, death benefits, and state Medicare and Medicaid benefits. The Council operates two nutritional programs at the Colony, an Elders Nutritional Program and the Summer Food Service Program for Children (BLM, 1993).

Water and Wastewater

Water

The unincorporated areas of Elko County get domestic water from natural springs and domestic wells. The County provides water service management assistance to various water districts and unincorporated towns.

The City of Elko is serviced by 19 wells. The municipal water system has a maximum flow capacity of approximately 17 million gallons per day, with peak summer usage of 12 million gallons per day and low usage in January of 3 million gallons per day. Water is stored in seven storage tanks (four 3-million-gallon tanks, two 1-million-gallon tanks, and one 1.5-million-gallon tank). The City is in the process of adding an additional 3-million-gallon storage tank, which would increase the City's total municipal water storage capacity to 18.5 million gallons (Vega, 1997). The City's water system is managed as an enterprise fund and is supported entirely by service fees.

Carlin is served by one deep well and one spring. The water system is in good condition and has never experienced water shortages. Water is stored in a 2-million-gallon tank. (BLM, 1993). The unincorporated area of Spring Creek, located southeast of Elko, maintains an independent water system for domestic use and fire protection. The system includes eight wells, and is currently being upgraded to increase pumping capacity (Spring Creek Association, 1998).

Wastewater

Elko Wastewater Treatment Facility located west of the city, is a fixed-film biological sewage plant. A fixed film system grows microorganisms on a fixed substrate (film) which absorb organic matter and nutrients from the wastewater. The facility has recently been upgraded to treat 4.5 million gallons per day. A second primary clarifier, a new biotower, and a second secondary clarifier have been added to the system. The 1996 average volume of wastewater treated by the facility was 2.8 million gallons per day. The City is currently in the processes of constructing a new digester to the system (Witmore, 1997).

The Carlin Wastewater Treatment Facility, constructed in 1990 at a cost of $2 million, is designed to serve 5,000 people at full capacity. This facility treats waste in settling ponds and disposes of treated water through a flood irrigation system (BLM, 1993).

Parks and Recreation

Recreational facilities within Elko County are primarily provided by the incorporated municipalities and private groups. One recreational program is funded entirely by a local gold mining company. The County maintains the County Fairgrounds. The city of Elko does not maintain a dedicated recreational department, but general recreation and golf are included in the County budget.

The City has four parks with a variety of developed facilities, one 18-hole golf course, a swimming pool, and a softball complex. (U.S. Department of Agriculture, 1996). The Spring Creek Association maintains recreation facilities for Spring Creek, including an 18-hole golf course, the Horse Palace (an indoor/outdoor equestrian facility), a private lake, and other facilities (Northeast Nevada Development Authority, 1998).

Libraries

The Elko County Library provides services throughout the County. The main library is located in Elko. There are seven branch libraries (including one branch in Carlin) and two bookmobiles (U.S. Department of Agriculture, 1996). The Eureka County Library is located in Eureka. The Elko-Lander-Eureka County Library system can be accessed on line at http://www.lib.nv.us/docs/NSLA/CLAN/elko.html.

Public Finance

Primary governing bodies in Elko County include the Elko County Commissioners, the Elko County Planning Commission, the Elko County School District, the City of Elko, and the Tribal Council of the Elko Band Colony-Te-Moak Tribe of the Western Shoshone Indians. Three elected Elko County Commissioners administer funds for community services and maintenance of the infrastructure. The Elko County School District, also governed by an elected board, administers the largest portion (approximately 38 percent) of the Elko County budget. Eureka County, like Elko County, is governed by an elected board of county commissioners. The cities of Elko and Carlin are each governed by a mayor and council which administer funds for community services (e.g., streets, water, law enforcement, fire protection, parks, and recreation).

Nearly half of Nevada's general fund revenues are derived from a 6 percent state tax on winnings from gaming. Other state taxes include a sales tax, gas tax, cigarette and liquor taxes, drug manufacturers tax, estate and lodging tax, and net proceeds of minerals tax. Nevada has a 6.5 percent sales tax of which 2 percent is retained by the state, 2.25 percent goes to local governments and school districts, and 2.25 percent goes to cities and counties.

The minerals industry is the only industry in Nevada that pays taxes to state and local governments on the basis of net proceeds. Mineral producers are allowed to deduct direct costs of production, such as mining and milling, and are taxed on the remaining amount (Nevada Department of Minerals, 1991). All Nevada businesses pay sales and use taxes based on the purchase of goods.

In 1994, the Bureau of Economic Analysis of the Department of Commerce ranked the per capita income for the 18 counties in Nevada. Elko County ranked 8th highest in Nevada with $21,785 per capita and Eureka County ranked 4th highest in Nevada with an average per capita of $26,984.

Table 3-37 provides a breakdown of the total revenues and expenditure for year ending June 30, 1996 for Eureka County, Elko County, and the City of Elko. The assessed valuation of property and net proceeds of mines for fiscal years 1995/96, 1996/97, and 1997/98 is provided in **Table 3-38**. Total assessed valuation of property collected by the state for

TABLE 3-37
GOVERNMENTAL REVENUES AND EXPENDITURES, YEAR ENDING JUNE 30, 1996

Revenues/ Expenditures	Elko County	% of Total	City of Elko	% of Total	Eureka County	% of Total
Revenues						
Taxes	2,258,724	17%	932,626	9%	2,751,001	31%
Licenses, permits and fees	765,129	6%	966,613	9%	9,038	.1%
Intergovernmental transfers[1]	6,068,025	47%	7,359,491	71%	5,049,696	58%
Charges for services	1,759,633	14%	584,834	6%	565,745	6%
Fines and Forfeitures	1,178,805	9%	158,829	2%	97,687	1%
Miscellaneous	978,096	8%	426,943	4%	265,554	3%
Total Revenues	13,008,412	100%	10,429,336	100%	8,738,721	100%
Expenditures						
General government	3,780,487	28%	1,019,999	11%	4,887,179	52%
Judicial	3,376,661	25%	89,436	1%	522,872	6%
Public safety	5,437,924	41%	4,223,809	48%	1,476,079	16%
Public works	477,779	4%	2,275,731	26%	-	
Health and sanitation	307,120	2%	114,485	1%	490,294	5%
Welfare	-		17,000	.2%	-	
Culture and recreation	-		1,078,824		583,299	6%
Community support	47,900	.4%	50,056	1%	369,087	4%
Intergovernmental			17,776	.2%	1,063,663	11%
Total Expenditures	**13,376,220**		**8,887,116**		**9,392,473**	

Source: Nevada Department of Taxation, Local Government Finance, 1997b.
[1] Includes Payment in Lieu of Taxes (PILT) and other state and federal tax transfers or grants.

TABLE 3-38
ASSESSED VALUATION OF PROPERTY AND NET PROCEEDS OF MINES (DOLLARS)

		1995-96	1996-97	1997-98
Elko County	Assessed Valuation of Property (Ad Valorem Subject to Revenue Limitations)	656,079,055	705,262,008	755,146,300
	Assessed Valuation of Net Proceeds of Mines (Ad Valorem outside the Revenue Limitations)	15,694,164	8,358,757	75,000,000
	Total Assessed Valuation	671,773,219	713,620,765	830,146,300
City of Elko	Assessed Valuation of Property (Ad Valorem Subject to Revenue Limitations)	218,633,312	231,475,367	247,881,803
	Assessed Valuation of Net Proceeds of Mines (Ad Valorem outside the Revenue Limitations)	29,000	10,000	137,000
	Total Assessed Valuation	218,662,312	231,485,367	248,018,803
Eureka County	Assessed Valuation of Property (Ad Valorem Subject to Revenue Limitations)	457,032,308	436,473,947	442,427,183
	Assessed Valuation of Net Proceeds of Mines (Ad Valorem outside the Revenue Limitations)	565,647,057	457,493,955	300,000,000
	Total Assessed Valuation	1,022,679,365	893,907,802	742,427,183

Source: Ambrose, 1997.

Eureka and Elko counties in fiscal year (FY) 1997/98 was about $742 million and $830 million, respectively. In Eureka County, $300 million of this amount was attributable to net proceeds of minerals tax, while in Elko County, $75 million was attributable to net proceeds of minerals tax (Ambrose, 1997).

Mining operations in both Elko and Eureka counties contribute both directly and indirectly to the Elko County revenue base. The mining industry pays property taxes which account for countywide property tax revenues. The mining industry also contributes to county revenues through a net proceeds tax. Approximately 40 percent of the net proceeds tax assessed in Elko County is retained in the county, with the remaining 60 percent going to the State of Nevada general fund (U.S. Department of Agriculture, 1996).

Over the last decade, annual tax revenues from gaming collected by the state in Elko County have increased from $37.6 million to $106.1 million. The gold mining boom in Elko County is generally responsible for increased gaming activity (Nevada Department of Administration, 1990).

The biggest share of revenues for Elko County, approximately 47 percent, comes from intergovernmental transfers from federal, state, and local sources. Payments from the federal government paid as compensation for lost property tax revenue from public lands are made under the Payment in Lieu of Taxes program. Property and other taxes, including net proceeds of minerals tax, provide about 17 percent of Elko County revenues followed by charges for services 14 percent), fines and forfeitures (9 percent), licenses, fees, and permits (6 percent), and miscellaneous (8 percent). Of $2,258,724 received by Elko

County in property tax revenues, $32,689 originated from net proceeds of minerals, and of the $765,129 from county licenses, permits, and fees, $343,249 was from gaming licenses and fees (Nevada Dept. Of Taxation, 1997b). Many intergovernmental transfers are associated with specific programs such as education or highways.

Approximately 31 percent of Eureka County revenues are derived from property taxes, including net proceeds of minerals tax, ($1,630,803), followed by intergovernmental transfers (58 percent) of which $76,122 was gaming tax revenues received from the state (Nevada Dept. of Taxation, 1997b). Of the $9,038 of revenues from county licenses, fees, and permits, $2,470 was from county gaming licenses and fees (Nevada Dept. of Taxation, 1997b).

Eureka County receives more revenues from property taxes than Elko County, primarily because of the extensive mining development.

Intergovernmental transfers account for the largest share (71 percent) of revenues of the city of Elko. About 1 percent ($139,110) of intergovernmental transfers is received from Elko County gaming licenses and fees. Approximately 15 percent ($141,705) of revenues from licenses, permits, and fees is from city gaming licenses and fees (Nevada Dept. of Taxation, 1997b).

In 1996, Newmont paid ad valorem taxes totaling $21.2 million, with $20.6 million going to Eureka County and $0.6 million going to Elko County. Of the total ad valorem taxes paid by Newmont in 1996, $3.8 million was derived from net proceeds of minerals tax, $3.6 million from property taxes, and $13.8 million from sales and use taxes. The sales and use taxes were paid directly to the state, which then redistributed the taxes to the counties. Taxable property value and taxes, paid by Newmont in 1991 and 1996**, excluding sales and use taxes are presented in Table 3-39. The lack of sharing of Eureka County taxes with Elko County, where most of the mining families reside, is considered a fiscal constraint by many Elko County officials and residents and an inequitable distribution of tax revenues (University of Nevada, College of Human and Community Services, 1991).**

Energy Generation and Distribution

Electricity, natural gas, telephone, and mobile communication services are generally available countywide and are provided by major utility suppliers.

Electricity service to the City of Elko and Spring Creek is provided by Sierra Pacific Power Company. Carlin receives its electricity from Wells Rural Electric Company, a member-owned, nonprofit electric distribution cooperative. Telecommunications in Elko County is served by Citizens Communications telecommunication company. Natural gas in Carlin and Elko are served by Southwest Gas Corporation. Other areas of the County are supplied with propane (Sierra Pacific Power Company, 1996).

ENVIRONMENTAL JUSTICE

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires that Federal agencies identify and address, as appropriate, disproportionately high and adverse human health or environmental effects that impact low income or minority populations as a result of Federal programs, policies, or activities. For this project, the federal action being considered does not present a potential for infractions of environmental justice for the following reasons: the project has been developed at its current location due to the location of the ore body. The ore body is located in a rural, mountainous area removed from any population centers or concentrations of minority or low income individuals.

TABLE 3-39
NEWMONT TAXABLE PROPERTY VALUE AND TAXES PAID

(In millions)	1991	1996
Taxable Value of Newmont Property	**(est.) $658.0**	**$985.6**
Net Proceeds of Minerals Tax	$10.1	$3.8
Property Tax	$2.4	$3.6
Sales and Use Tax	$7.8	$13.8
Total Ad Valorem Taxes Paid by Newmont	**$20.3**	**$21.2**
(Portion attributable to Eureka County)	($18.4)	($20.6)
(Portion attributable to Elko County)	($1.9)	($.6)

Source: Newmont, 1997e.
Note: Data apply to the Nevada, Carlin Trend property only.